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THE TRAMWAY AND RAILWAY WORLD

AN ILLUSTRATED REVIEW OF PROGRESS IN ELECTRIC AND OTHER TRACTION

Established in 1892.

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THE Tramway & Railway World
A REVIEW OF CURRENT PROGRESS IN ELECTRIC AND OTHER TRACTION

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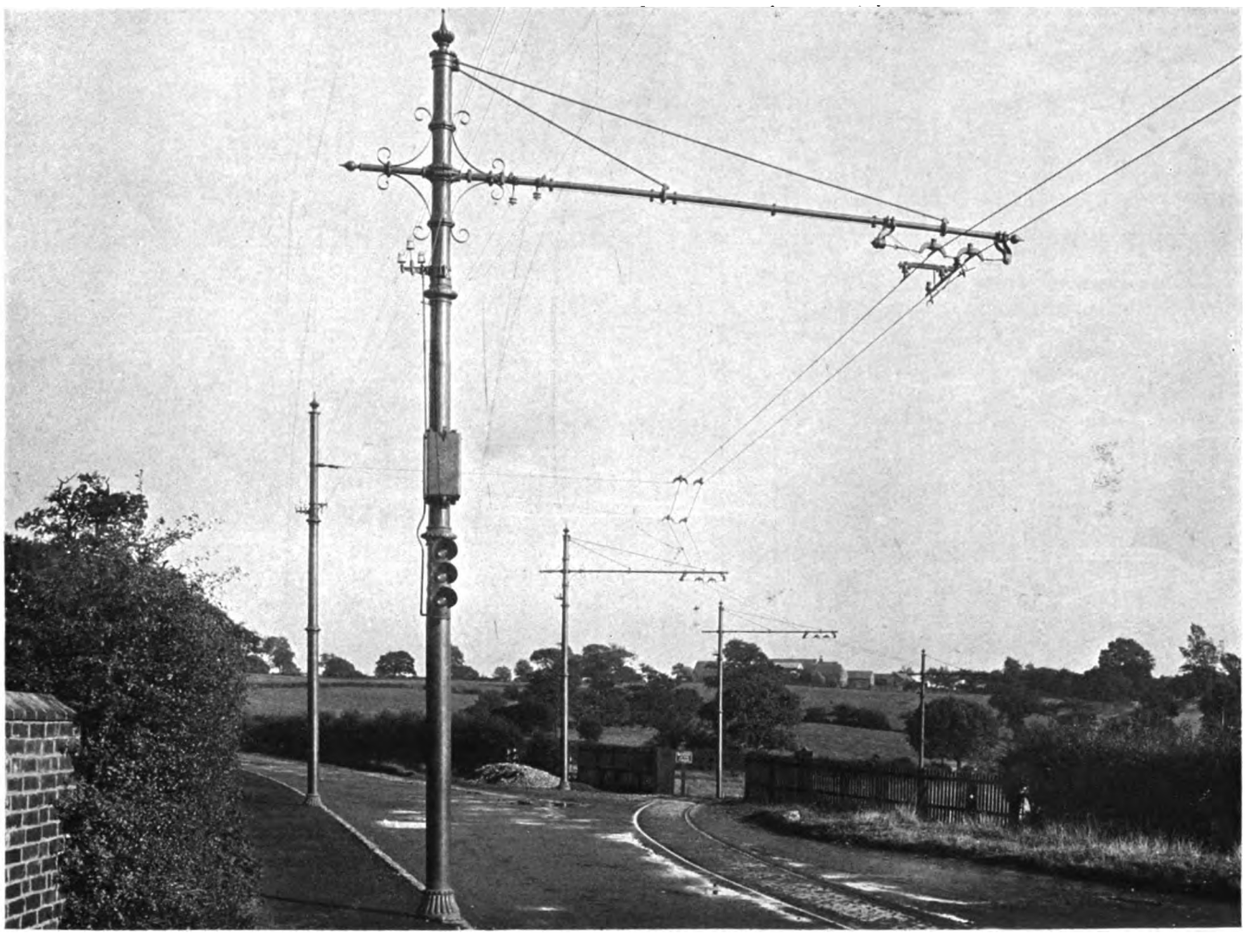
SIGNALS FOR TROLLEY CAR LINES.

The use of signals for the protection of street railway and interurban lines has made remarkably small progress in America. This is the more noteworthy owing to the great lengths of trackage on the interurban lines, and the high speed at which cars travel. In by far the greater number of cases the movement of cars is determined by the schedule or time table, which may be modified by instructions from the train dispatcher. This officer has the same functions as his namesake on a steam road, and acts as the nerve centre for a whole district, keeping in touch by telephone with all the cars and regulating their movements in exactly the same way as a train dispatcher does with trains on a railway.

In Great Britain the conditions are very different. We do not have the long stretches of line, nor the high speed, and there has not, therefore, been the same need for signals for the protection of opposing or following cars. What signals have been provided here have in all cases been placed where an obstruction prevented opposing cars, each of which have to pass over a piece of single track, from seeing each other. There are about four well-known signal systems for trolley car lines in America, and about five in this country, and it is the purpose of this article to describe these.



Signal Apparatus on Burton and Ashby Light Railway.

Taking America first, the oldest is that of the United States Electric Signal Company, the

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system referred to by Lieutenant-Colonel Yorke, of the Board of Trade, in his report on his visit to America in 1902. It is somewhat a misnomer to apply the word "oldest" to this method of signalling. It was only introduced, in a crude form, in 1898, but the term is none the less true.

The type of signal employed is illustrated by Fig. 1. On the right is a red disc, pivoted at the sides, and 8 in. in diameter. As seen in the illustration, it has been turned clear, and indicates

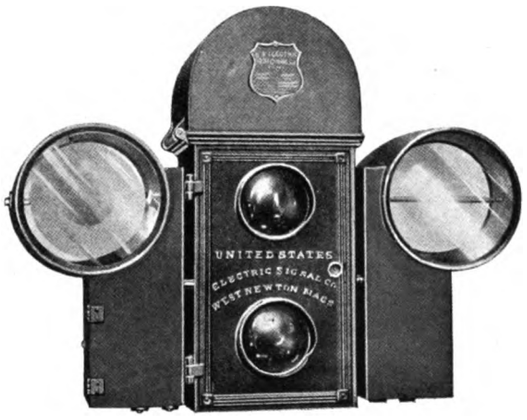

Fig. 1.—Exterior of Signal Box showing White Semaphore Set.

that the section is free. On the left is a disc of similar size, but painted green in the centre and white on the outside. In the centre of the standard, and between the two discs, are two lamps, an upper and a lower. Behind these are electric bulbs which, when switched in, show red in the upper lamp to correspond with the red right hand disc, and white in the lower lamp to

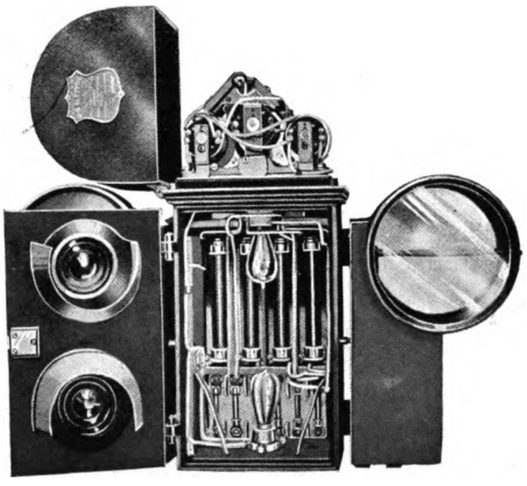

Fig. 2.—Interior of Signal Box showing Mechanism in Place.

correspond with the left hand disc. In the upper part of the standard is the relay which operates the discs. Fig. 2 is a photographic view of the internal mechanism with the door open, and in the latter are the lenses through which the lamps give their light.

These signals are employed for protecting sections of single track, and one is fixed at each end of a section and immediately inside the single line portion. In Fig. 3 is given the wiring diagram, with a car in the section proceeding from left to right. When the car, represented by the wheel, entered the block, it closed the right hand contacts of the trolley switch for an instant, allowing the current to flow over the circuit represented by heavy dashes, through magnet A and over line wire No. 3, through the other signal to the ground. The path taken is shown by the heavy full line. Magnet A on being energised throws over its contact lever, disconnecting the ground at this, the setting end, and cutting in a permanent feed from the trolley wire to take the place of the switch contact, which opens immediately after the car passes. This permanent feed also throws the white and green lamp and disc into signalling circuit, and this indicates to a motorman that the danger signal is exhibited at the other end of the section. The other set of contacts closed by this magnet complete a circuit which starts in the outside contacts of both trolley switches. It will be seen upon looking at the diagram that the signalling circuit leads through magnet B^1 at the other end, opening a pair of contacts known as the non-interference device. These contacts open the setting circuit

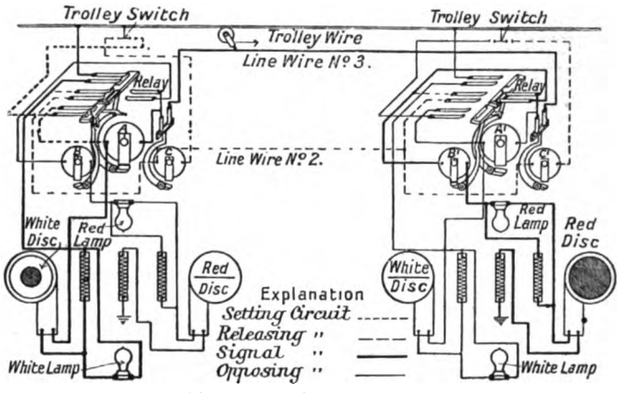

Fig. 3.—Wiring Diagram.

from the trolley switch, and prevent a car trying to enter from the opposite end, locking up the lever to magnet A^1, which would connect both ends of the signalling circuit to the trolley wire, making a dead signal until some car passed out of the block.

The circuit indicated by light dashes is known as the releasing circuit. When the car leaves the block, going in the direction shown by the wheel, it closes the right-hand contacts in the right-hand switch, thus allowing current to flow through magnet C^1, which breaks the main signalling circuit, and also through magnet B which unlocks the lever of magnet A. The magnet A, now being de-energised and the lock open, allows the lever to fall back, and the system is in its normal position with no car in the block.

The next American system to be noticed has advantages over the one just described inasmuch as it allows cars to follow one another through a section, which the United States system does not provide for. The improved method is the "Eureka." Four sets of lamps are employed in

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this system. Before reaching the points and entering on the single line there is a two-way lamp, which may be termed lamp *a*. When switched in, it shows a red light to an approaching motorman, and when the other lamp is switched in, it shows a green light in the rear; the object of the latter will be noticed later. Immediately inside the single track section are a pair of lamps *b*, *c*, only one of which can be alight at one time, and when the section is normal and unoccupied neither are burning. At the far end of the section are three similar lamps, but facing the opposite direction, with the green side of the lamp similar to *a*, facing an approaching motorman who has come through the section.

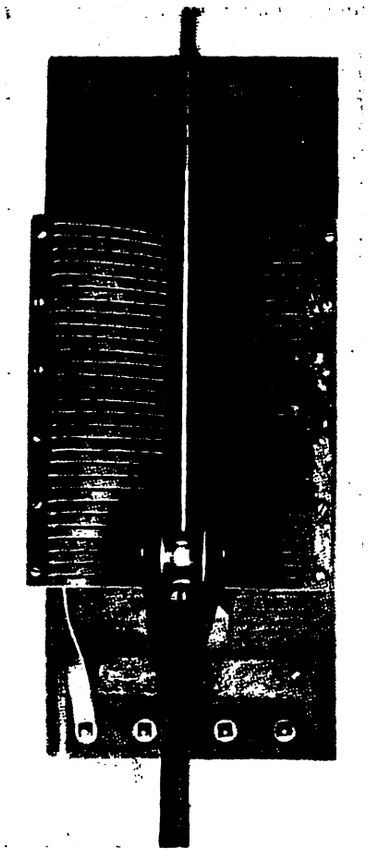

Fig. 4.—Contact Maker for Overhead Construction.

Suspended immediately inside the section is a contact maker similar to that seen in Fig. 4. This has flexible teeth which, when pressed in by the trolley wheel, make contacts. On one side is a contact plate the whole length, and on the other side are two shorter plates. Included in the mechanism are two controllers—one for each end.

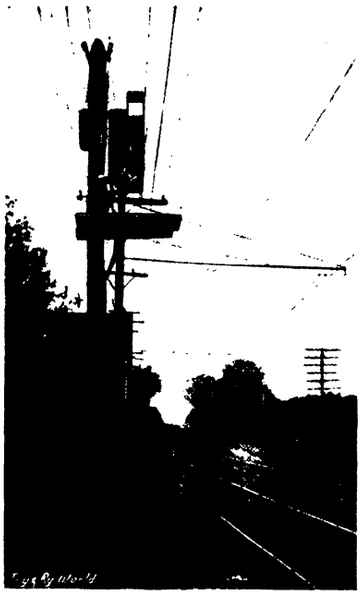

Fig. 5.—Semaphore Set at Clear.

When a car approaches the entrance to the section no lights are burning. As soon as contact is made, one of the green lamps *b*, *c*, at the entrance is switched in, which advises the motorman that the section is clear. At the same time the red light at the far end of the lamp similar to *a*, which we will name a^1, is switched in, in order to stop any car from coming in the opposite direction. Should a second car wish to enter from the same end as the first, no red light would be showing in *a*, but the driver would see that a car was ahead of him by lamp *b* or *c* being alight. When the second car made contact, the only change in the signals would be that the lamp *b* (or *c*) would be switched out and its mate switched in. This would be an indication to the motorman that all was working. The second car also moved the controller one notch forward, so that when the first car left the section the lights would remain burning, and as the man looked forward on passing the contact maker at the far end he would see that the green light in a^1 had not been switched out, and it would be an indication to him that a car was following. For each car that enters, the controller is moved one notch forward, and as each car leaves at the other end, and the contact maker there struck by the trolley wheel, the controller is moved one notch back until all the cars are out, when the controllers are normal and all lights are switched out. Should a car enter against a red signal, all lights are switched out, so warning the erring and all motormen in the section. If the car stops, and backs out, the *status quo ante* is restored.

The Blake Signal and Manufacturing Company have a very good signal system for trolley car operation. It is not so much for protecting their working as for a train despatcher getting in touch with cars on the line. At each crossing place and station a signal is provided which normally is held upwards at "clear." This is set to "danger" by the operation of a pendulum. In the train despatcher's office are a number of pendulums varying in length and corresponding to the number of signals under his charge. Should he wish to speak to a car approaching, say, No. 8 signal, and give the motorman instructions, he puts a plug into No. 8 hole. This sets in motion No. 8 pendulum in his office by means of an electro-magnet. Each signal has an electro-magnet and a pendulum, which correspond in length with their fellows in the office, and which are all in series on a single wire. When a pendulum in the office commences swinging all those at the signals swing also, but the impulses are only cumulative in increasing the arc of vibration of that pendulum whose period is synchronous with the pre-determined period of electro-magnetic impulses. The intended pendulum in a few seconds swings through an arc of sufficient length to trip the lock holding the semaphore, and it at once falls to the "danger" position. A light is switched in simultaneously for night use, and a circuit is automatically completed which intimates to the train despatcher that the signal has responded.

After the motorman has stopped and receives his instructions, he pulls a cord which again raises the signal to "clear," as seen in Fig. 5.

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The first signal installation on a British tramway was carried out at Dover for Mr. Henry Stilgoe, then borough engineer, by Messrs. Saxby and Farmer. In Fig. 6 is a diagram of the lines protected, and in Fig. 7 is a diagram of the electrical connections between two signals. At the turn-outs pillars have been erected on which are placed the instruments which contain in the upper part two miniature signals, and below, protected by a door, are four plungers, a pair, one white and one black, for each signal. The signal on the right hand side works simultaneously with the left hand signal of the next pillar on the right.

As long as the signals are down the line is free, but no motorman may enter a section until he has pressed in the black plunger for the section he is entering, which raises his own signal and that at the far end of the section. On

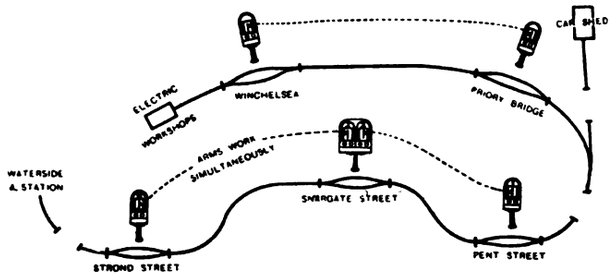

Fig. 6.—Diagram Showing Position of Signalling Points on Dover Tramways.

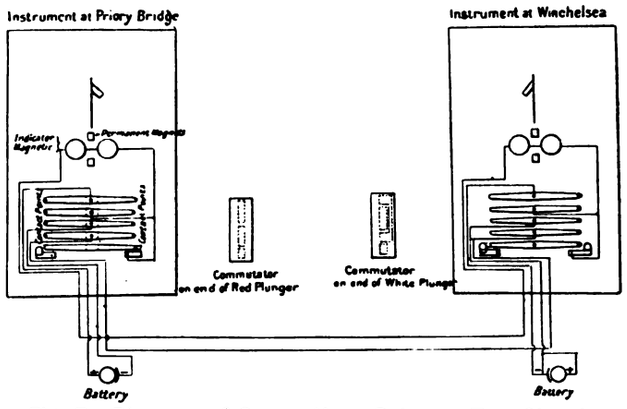

Fig. 7.—Diagram of Connections Between Two Signals.

arrival at the other end he presses in the white plunger, which lowers both signals and indicates that the line is free.

The Harison signal, designed by Mr. Harison Jones, is in use at Southsea, Twickenham, and Swindon. For protecting a single track the arrangements are as in Fig. 8. At the extremities of a section there is a signal arm, S^1 at one end and S^2 at the other, which are carried on the trolley wire pillars.

In the trolley wire are two switches—1, 2. When contact is made at switch 1 a circuit is completed through signal S^1, preference solenoid p by the auxiliary wire, through locking solenoid l^2 of signal S^2. This locks the latter signal and lowers the former. When the car passes off switch 1 solenoid p is de-energised, and the signal arm goes to danger by gravity. Switch 2 is now reached, and this energises locking solenoid l^1, which now locks signal S^1, as well as S^2, at danger, but when switch 3 is reached at the far end of the section solenoid u^1 of S^1 and u^2 of S^2 are energised, and these unlock their respective signals. Switches 4, 5, and 6 act similarly for the opposite direction.

Siemens Brothers and Company, Limited, are the makers of a signal system which is in use at Pontypridd. The arrangement of connections is as shown in Fig. 9. A car, C^1, is travelling from right to left. It has passed section insulator I^1 and is taking current from the feeder F through the solenoid S^1, and in so doing attracts the armature A^1, so completing the circuit of the signal lamps L^1 L^2 from the feeder F to the earth plate E^1. Lamp L^1 has a green lens, and when alight indicates a clear road. Lamp L^2 has a red light, showing in the opposite direction and indicating danger, and these lamps, also those (L^3 L^4) for the opposite direction, are fixed 30 or 40 yards in advance of the section insulators. As the car passes under I^2 the armature A^1 returns to its normal position, due to the current taken by the car C^1 through the solenoid S^2.

The Electric Tramway Equipment Company have an apparatus, illustrated by Fig. 10, which is in use on the Swindon tramways. The cast-

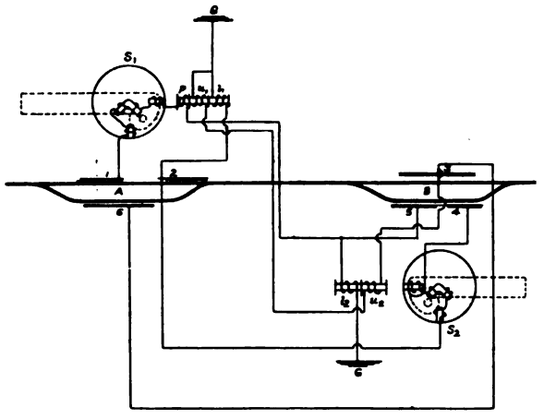

Fig. 8.—Harison Signal.

iron signal box is fixed on a pillar about 6 ft. above ground level. It contains two 16 c.p. 250-volt incandescent lamps and a two-way switch. There is a box at each end of a section, and the four lamps are in series. No car is allowed to enter a section when the lights are burning. If they are out, the conductor must turn the switch before entering, which switches in the lamps. When he leaves the section at the other end he must turn the switch there, which extinguishes the lights.

Fig. 11 represents the system installed by Messrs. Brecknell, Munro, and Rogers, of Bristol, on the Burton and Ashby Light Railway; also at Bristol, Bath, Sheffield, and Wemyss. The method employed allows cars to follow each other through a section, but no opposing car may enter until all those from the opposite

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direction have arrived and passed off the single line section.

For each section there are employed four

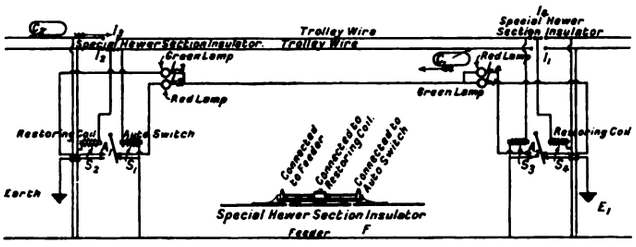

Fig. 9.

overhead line contacts, two sets of lamps, and two switch boxes. Each road has an ingoing and an outgoing contact, which is attached to the trolley wire. The trolley wire is not broken, but goes straight through, and when the trolley head passes the contact the latter is pushed aside so that an electrical circuit between the trolley wire and the contact is closed.

A car travelling from left to right first makes contact with *a*, which causes current to flow from the car into the rotary switchbox *b*, causing magnet *c* to be energised, so that the rotary switch *d* revolves one step forward and thereby switches in the light *e*. Should a second car enter the section before the first had left, the rotary switch is moved another step forward. When the first car leaves the section it makes contact with a^2,

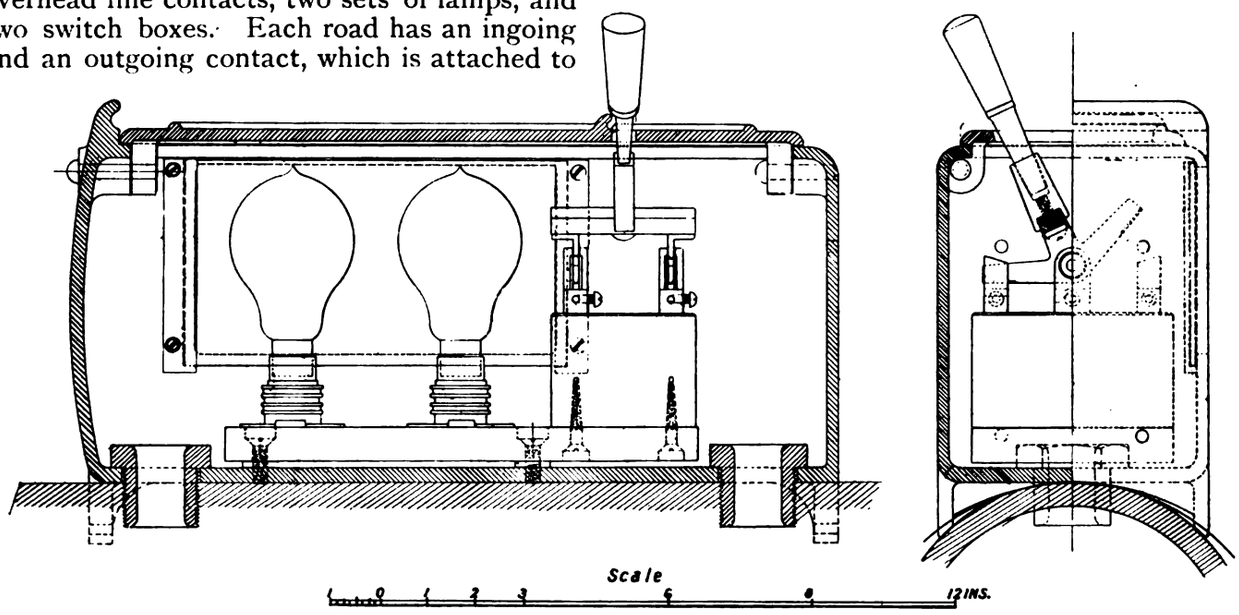

Fig. 10.

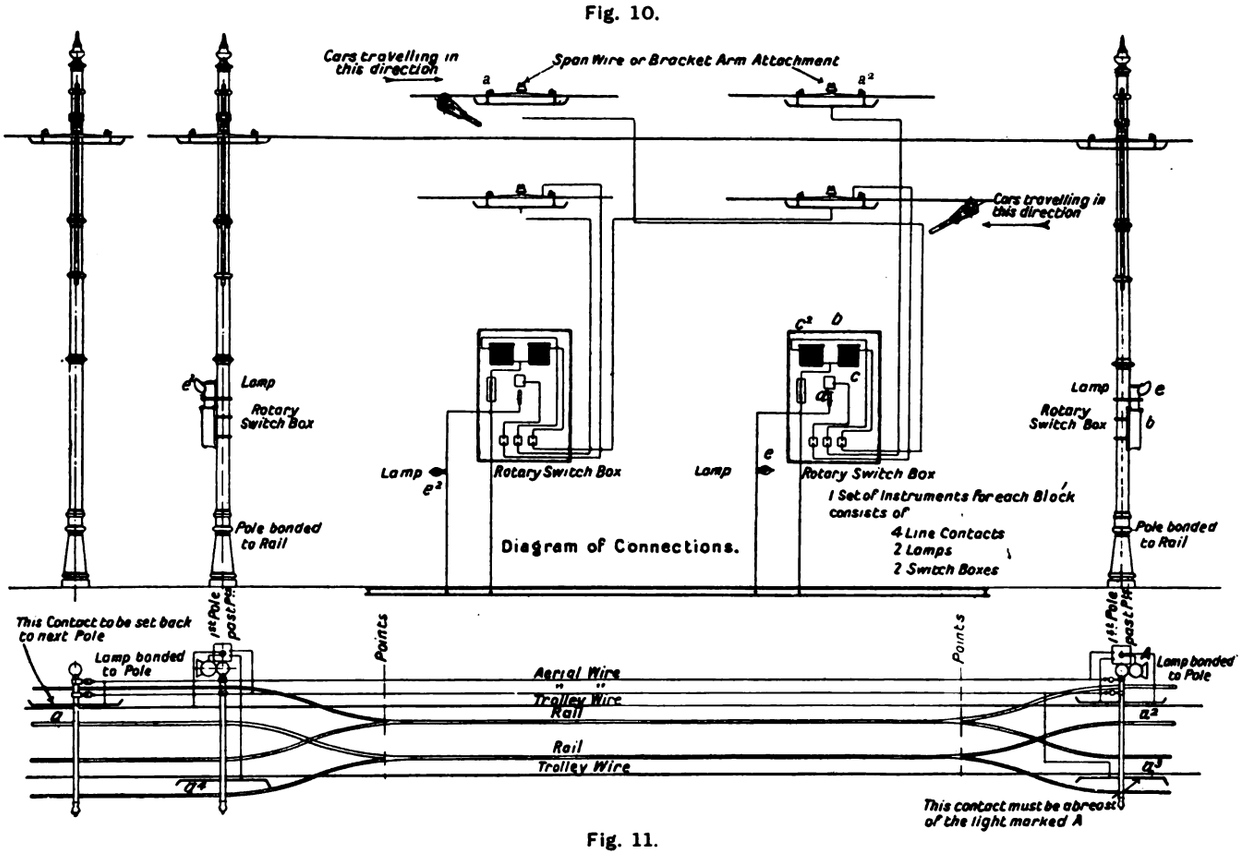

Fig. 11.

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so that magnet c^2 is energised, and this revolves the rotary switch d one step backwards. Were it the only car, the switch would have only moved one step, so that this backward movement would have put out the light e. If, however, there is a

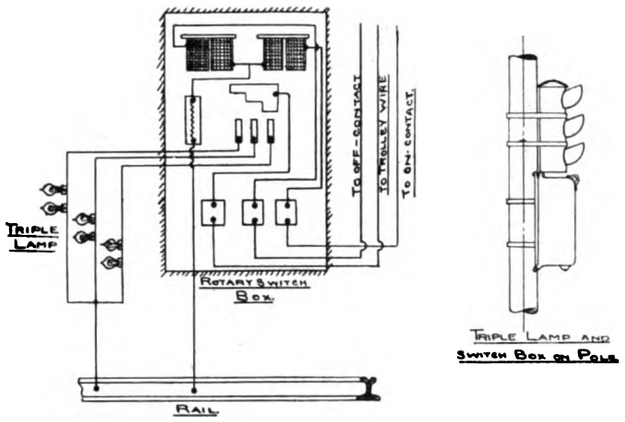

Fig. 12.—Connections of Rotary Switchbox of Brecknell, Munro, and Rogers.

car still in the section the light would remain burning until the rotary switch had been stepped back to normal. For a car entering from the other end, contact would be made at a^3 and broken at a^4, and the light e^2 would govern the movements.

One of the pair of ingoing contacts has to be 40 yards' length back from the lamp, so that it may light the lamp at the other end before a car can enter from the opposing end, also that of two cars entering simultaneously one shall have a greater advantage of securing the road.

The ingoing contacts are staggered, so that there is no possibility, in the event of two cars passing under them simultaneously, of their both entering the block section, as the driver coming from the end at which the contact is farthest from the points would see the danger light before he got to them.

The lamps may have a single light or may be provided with two or three lights as shown in Fig. 12, where it is considered necessary to advise a driver as to how many opposing cars are in the section. The lamps are protected by an efficient hood from being blinded by the sun's rays.

BONDING.

By E. Goolding.

If it were not for the bonding of track rails the resistance offered by the joints would be so high as to prohibit the use of the rails as a conductor for conveying the return current back to the switchboard. At present, both tramways and railways take advantage of the track rails as a return conductor. The conducting power of steel rails depends upon their composition. Where a steel rail is used as a conductor only, and not as a track rail (such as a third or fourth rail on railways, and the tee conductor bars used on the conduit system for tramways), high conductivity is of importance, and the conductivity of such rails is usually about 15 per cent. that of copper, or in other words, one to seven of copper. Track rails, on account of the wear and tear to which they are subjected, have to be of harder steel, thus the conductivity varies from ten per cent. to eight per cent. that of copper, in the latter case the ratio being nearly one to thirteen of copper.

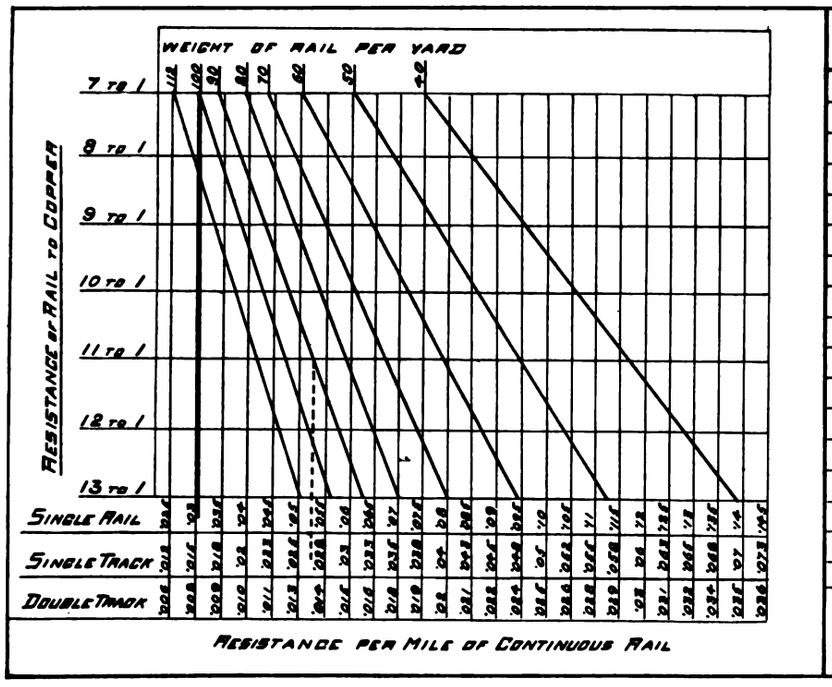

Table No. 1.—Rail-Weight Resistance Ratio and Resistance per Mile.

C.M.	B&S	S.W.G	No	Area Sq. Inch
121,000		00	1	·095
"		00	2	·190
133,000	00		1	·104
"	00		2	·208
138,000		000	1	·108
"		000	2	·216
160,000		0000	1	·125
"		0000	2	·25
166,000	000		1	·131
"	000		2	·262
212,000	0000		1	·166
"	0000		2	·332
300,000			1	·235
300,000			2	·570
500,000			1	·375
500,000			2	·750
500,000			3	1.125

Table No. 2.—Area and Sizes of Bonds.

This high resistance greatly reduces the conducting values of the track, but owing to the heavy rails adopted in modern track work their use as a conductor still entails an immense saving in copper. For example, tramway track rails may be taken at 100 lb. per yard, in which case each rail has a sectional area of approximately 10 sq. in., and a double track will consequently have 40 sq. in., which, at the ratio of 13 to 1, the

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conducting power if of the double track is equal to $\frac{18}{6}$ = 3 sq. in. of copper.

The limits within which track rails may be used as return conductors are regulated by the Board of Trade requirements, which stipulate that the difference of potential (during the working of the tramway) between the points of the uninsulated return (or track) rails furthest from and nearest to the generating station shall not exceed 7 volts, and that the current density shall not exceed 9 amperes per square inch of rail. These regulations are necessary to obviate the electrolytic action which might otherwise be set up in adjacent pipes if a greater difference in potential is allowed.

Railways using the track rails as return conductors have as much as 20 volts drop, but in this instance the conditions differ from a tramway, inasmuch as there are no pipes (other than those belonging to the railway company) sufficiently near to be affected by electrolytic action; in addition the track rails being supported on wooden sleepers are, more or less, insulated from earth.

It would be interesting to consider to what exten bonding affects the resistance of the track.

Track rails are usually laid in lengths of 30, 40, or 60 ft., and it is therefore necessary that these lengths be made metallically continuous to obtain an efficient conductor. In one mile of single track (of 30 ft. lengths) there are 352 joints, and if in bonding 352 joints one bad bond is made it will neutralise the advantages gained by good bonding throughout the entire length; in other words the strength of the chain is its weakest link.

The exact type and size of bond to be used depends upon circumstances, but, whatever the type of bond employed, the greatest care must be exercised in the final fitting and bonding, the most vital point to be adhered to is to always allow the final cut to be taken out of bond holes with a fluted reamer, leaving the hole smooth and clean and a tight fit for the bond. It would, perhaps, be interesting at this point to draw attention to the necessity of allowing sufficient metal to be reamered out. The holes often being punched,

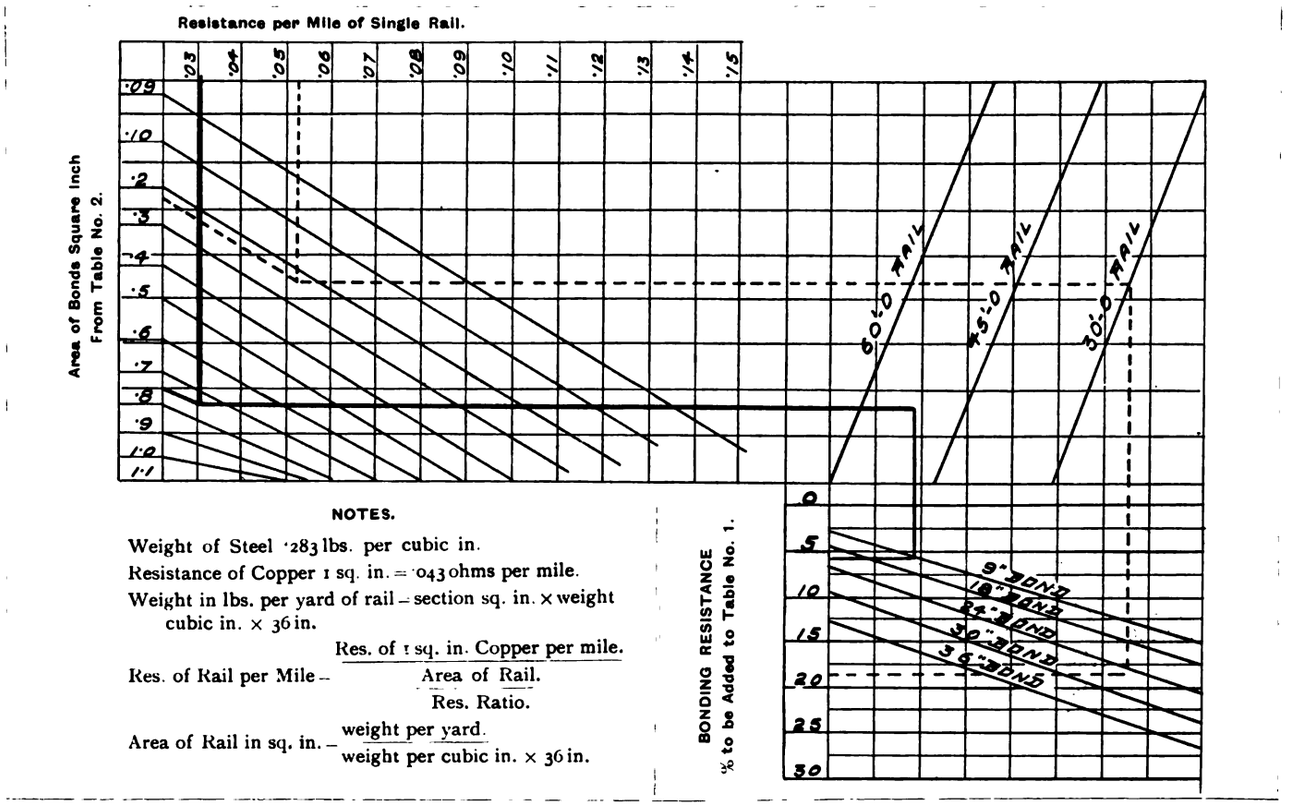

Table No. 3.—Bonding Resistance.

Owing to the fact that both track and third rails are usually laid in comparatively short lengths, there would be no efficient electrical continuity without bonding, as the only path would be through the fish plates (and in the case of tramway track the additional assistance of sole-plates); these of course materially assist the conductivity of the rail, but not sufficiently to be of practical service under the existing conditions and regulations ruling modern tramway and railway work.

The main idea of bonding is to reduce the resistance of the track so as to comply with the Board of Trade regulations, and upon the following conditions depends the total resistance of the track:

(1) Number of rails parallel.
(2) Sectional area of rail.
(3) Ratio of resistance of rail.
(4) Number of joints per mile of rail.
(5) Sectional area of bonds per joint.
(6) Length of bonds used.

it is not to be expected that they will be true. In addition, the effect of rust has to be considered. On a recent contract, involving the expenditure of some £8,000 for bonding, it was found from experience that the holes must be punched $\frac{1}{8}$ in. small to obtain a clean metallic surface in the hole when reamered. In fact, it is often an advantage to drill the holes $\frac{1}{16}$ small, and then to have them reamered; this, although expensive, prevents the reamers being damaged by the skin left in punched holes. It is most unsatisfactory, as regards the efficiency and life of the bond, to attempt to bond in rough, burred, wet, or oily holes, nor is it advisable to leave the hole for any length of time after reamering, as a surface of rust is liable to form and seriously affect good metallic contact. The burr left after reamering should be taken off with a countersinking tool so as to give a good edge for the bond to hold against.

The bond terminal may with advantage project $\frac{1}{8}$ in. beyond the face of the hole, so that when the centre

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pin is driven in or the press is used this $\frac{1}{8}$ in. projecting portion of the bond will act as a head to help keep the bond terminal ridged; these points are important factors in obtaining the economic use of the track rails as a return conductor.

The actual resistance of a bonded track can only be obtained by measurement. This, however, is not always possible, but a close approximation can be arrived at with the assistance of the accompanying tables:

Diagram No. 1 gives the weight, sectional area, ratio of resistance to copper and resistance per mile of the principal sizes of rail in use either for a single rail and single or double track (continuous unjointed length).

Diagram No. 2 gives the area in square inches of the various sizes and numbers of bonds used per joint.

Diagram No. 3 gives the percentage of resistance to be added (to table No. 1) for bonding.

Example No. 1.—Supposing it is required to obtain the resistance per mile of a single track with 90 lb. rail having a ratio of 11 to 1 of copper, and the rails being laid in 30 ft. lengths, and the joints bonded with two 000 S.W.G. 24 in. bonds = ·0306 ohms. In the first instance by following the dotted line on diagram No. 1 the resistance of 1 mile of continuous single track to the above conditions = ·026, and to this should be added the jointing and bonding resistance from diagram No. 3, the dotted line illustrating the point under consideration. First, from diagram No. 1 we have the resistance of a continuous single rail to the above conditions, and from diagram No. 2 the sectional area of two 000 S.W.G. bonds; with these two items as a basis, we follow through on diagram No. 3 until we touch the line depicting 30 ft. length of rail; the only condition then left is the length of bond, and by dropping down, to the 24 in. line we obtain opposite, the percentage of resistance to be added, which = 18 per cent.

Resistance of continuous single track	=	·026
Additional 18 per cent.	=	·0046
Total resistance of track		·0306

Example No. 2.—In this case it is assumed we have one mile of single third rail, 100 lb. per yard, having a ratio of resistance of 7 to 1 and laid (60 ft. and 45 ft., average 50 ft.) 50 ft. lengths, and each joint bonded with two 500,000 C.M. 9 in. bonds = ·0321 ohms.

The same method is adopted as in the previous example, and if by following the full line (diagram No. 1) for a single continuous rail the above area and ratio is found to be = ·03 and the resistance due to bonding is shown by the full line, and is in this instance = 7 per cent.

Then resistance of continuous rail	=	·03
Additional 7 per cent.	=	·0021
Total resistance		·0321

The relative conductivity of the bonds is usually about $\frac{1}{8}$ the conductivity of the rail for tramways, but on third rail, as very high efficiency is required, the conductivity of the bonds is often as great as the rail.

In example No. 1 there are two 000 S.W.G. bonds per rail, or four bonds for the single track, which = ·432 sq. in., and one 90 lb. rail = 9 sq. in. and 18 sq. in. for the single track, but since the ratio of resistance is 11 to 1, the track = $\frac{18}{11}$ 1·7 sq. in. of copper, therefore the relative area of bonds = $\frac{1 \cdot 7}{\cdot 432} = \frac{1}{4}$ the conductivity of the rail.

It is usual to cross-bond every 40 yards between track rails, and every 80 yards between the inside rails in the case of double track. It is necessary to parallel the conductors so as to enable one to assist the other, and in the case of damage or repairs to any rail conductivity is thus obtained through the adjacent rails. This cross bonding has no effect on the resistance of the combined lines, and, although not necessary, these cross bonds are often put in the same size as those used in bonding the joints. This has been found advisable mainly for mechanical strength.

THE BRIGHTON RAILWAY ELECTRIFICATION.

It is now two years since the contracts were let for electrically equipping the Victoria and London Bridge section of the London, Brighton, and South Coast Railway. After what seems to be long delay, there is a prospect of the work being speedily completed. It may be remembered that the line is to be worked on the single-phase system, and it will be the first railway in this country to use that method. Winter-Eichberg single-phase motors will be used on the cars. Instead of a third rail as electrical conductor an overhead wire is used, and it carries the single-phase high-pressure alternating current. The track rails are employed for what is called the return, though that expression is hardly correct in the case of alternating current, seeing that rails and overhead wire are alternately positive and negative during every complete cycle. The rails, of course, are not insulated, so that there is no danger to life from them. During the half-period when they are positive the overhead wire, which is insulated, has a potential negative to earth, corresponding to its positive potential during the other half of the cycle

Bracket Poles for Overhead Transmission.

The rolling stock, which is being built by the Brush Company, and the electric equipment for it which is being manufactured by the British Thomson-Houston Company, are understood to be well advanced, and the arrangements of the London Electric Supply Corporation, from whom the necessary energy will be purchased for providing the current, are also in a forward state. Cable ducts for the feeders have been laid along the side of the railway, the usual arrangement being shown in the accompanying photographic views, where it will be seen that the duct is carried a little above the ground on short supports.

At one or two points on the line the work of erecting the overhead equipment has been begun by the contractors, Messrs. R. W. Blackwell and Company. The illustrations show two types of support used. One consists of a strong steel lattice pole, about a square foot in

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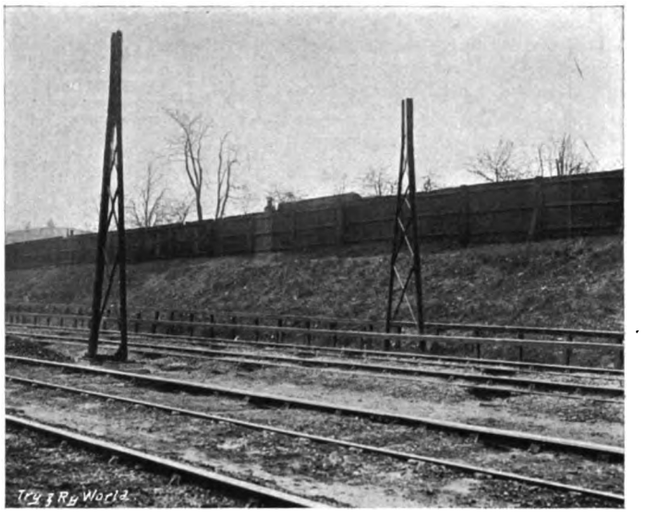
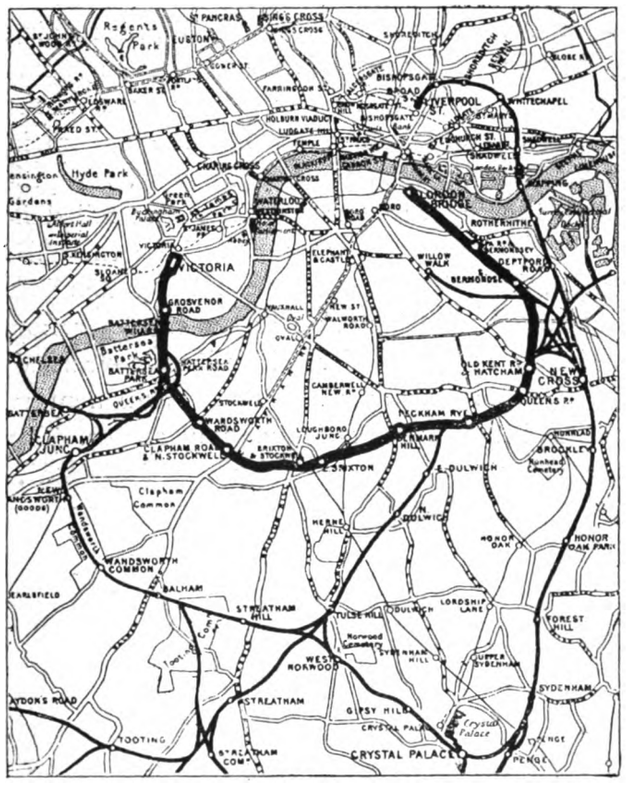
cross section at the base. It is deeply bedded in concrete. Owing to fore-shortening, the view does not show the structure of the bracket arm. It really consists of two parallel members spaced a few inches apart and tied together at the extremities. The arm is firmly secured to the pole, and is also supported from the top of the standard by two straps in tension. From this bracket arm the conductor wires for the two tracks will be suspended. The poles are spaced rather near one another, so that a very strong construction may be obtained. On other parts of the route, where the two electrified tracks are not paralleled by others of the same company, standards of A shape are used. They are placed opposite each other on both sides of the railway, and each pair will be united by a cross member from which the wires will be hung. These standards are built up of steel angle frames, tied together by short braces.

Bracket Construction on Curve.



Side Pole Construction.



Brighton Company's London Suburban Lines.
(Heavy Line Shows Electrified Route.)

It is expected that electric operation will begin in the coming spring. Except during the busier hours in the mornings and evenings, this line does not carry a heavy traffic, and, indeed, in the middle of the day the intervals between the trains are very long, considering that over practically all the route the country is built upon. People, however, in the southern outskirts of London do not appear to move about locally to any great extent. Owing to the shape of the route there is practically no through traffic, the detour from Victoria to London Bridge covering a distance of eight miles. Electric tramway competition in some parts tells against the line. With electric traction no doubt trains will be run more frequently and more rapidly. From a railway traffic point of view it may hardly seem worth while to have electrified the line, but under the new system it is to be hoped that business will largely increase. In any case the railway company wished to experiment with this electric system with an eye to possible future developments, and probably they could not get a better practising ground than this line, which is self-contained, and it may be called isolated, from the traffic point of view.

The Torquay Tramways Company has been registered with a capital of £120,000 in £1 shares. The objects are to adopt an agreement with the Dolter Electric Traction, Limited, and to construct, maintain, and work tramways authorised by the Torquay Tramways Act, 1904.

London Omnibus Fares.—Under the agreement arrived at with the London underground railway companies, the omnibus companies raised their short distance fares on many routes on December 15 by the expedient of shortening the length of the penny stage. The increase applies to horse as well as motor 'buses. Probably the best-known of the long penny stages was that between Charing Cross and the Bank of England. It has now been divided into two overlapping penny stages. The electric 'buses which run over this route have not raised their fares, but these vehicles at present are few in number.

London Tube Railway Fares.—A conference of representatives of the Baker Street and Waterloo, the Charing Cross, Euston, and Hampstead, the Great Northern, Piccadilly, and Brompton, the Central London, the Metropolitan District, the Metropolitan, the City and South London, and the Great Northern and City Railway Companies, was held on December 2 for the purpose of considering the question of fare revision. The subject was thoroughly discussed, as was a particular project for through fares between any two or more of the railways. On December 15 the revised fares came into operation between a number of stations on the District, Baker Street and Waterloo, and Piccadilly Railways. Several 1d., 1½d., and 2½d. fares are raised by a halfpenny, and a few 2d. fares are increased to 3d.

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THE
Tramway and Railway World

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We shall be pleased to receive at all times articles, papers, notes, and correspondence on subjects of interest to those concerned in the financial administration, construction, or management of tramway and light railway undertakings. Particulars as to the issue of specifications, the progress and completion of contracts for new work, and suggestions for improvements in all branches of tramway enterprise will receive special attention.

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LONDON, JANUARY 2, 1908.

1907. The past year has not been an exciting one in the field of electric traction, but it has seen some notable events both at home and abroad. In reference to foreign countries, it may suffice to say that electric lines continue to extend, that single-phase working is now definitely on its trial on a large scale on the New York and Hartford Railroad; that the electrifying of horse lines and the construction of new electric tramways have been prominent features of the year both in the far east and in South America; and that the great tunnel undertakings for connecting New York with Long Island and New Jersey are now far advanced. At home, the most important works in progress which were completed during the year were the Birmingham Corporation tramways, the Charing Cross, Euston and Hampstead Railway, the Euston extension of the City and South London Railway, and the electrification of the Hammersmith line of the Great Western Railway. The electric railway system of London now forms a network of communications of extraordinary convenience and efficiency. The electric railway work now in actual progress is confined to the single-phase installations for the London, Brighton and South Coast Railway in London, and for the Midland Railway at Morecambe. These will be completed during the present year. Other authorised schemes have not yet been commenced.

* * *

Tramway construction has been confined to extensions of urban systems and the completion of some interurban lines. The most important work of the kind still in progress is the electrification of the great undertaking of the London County Council. This work on the south side of the Thames is nearly completed, but new lines are still building on routes where there were no tramways before. North of the Thames a great deal still remains to be done in changing from horse to electric traction, but the work is being pushed forward with considerable speed. But for the state of the money market, progress would have been still more rapid. Most of the construction is on the expensive conduit system, but a long line from Hammersmith to Harlesden on the overhead wire system is now being begun, and the G.B. surface-contact system is being installed from Aldgate to Bow. In Middlesex and Hertfordshire, further extensions have been opened of the great light railway system in these counties, while to the south-west the London United Tramways have been spreading further over Surrey. Surface-contact systems have been in evidence, as the year saw the completion of lines on the Dolter system in Mexborough, Hastings, and Torquay, the proposal for the same system being installed in Oxford, and the beginning of work on the G.B. system (as already referred to) in London. The prospects of new work for the year now beginning are large so far as London is concerned, but limited elsewhere. The Parliamentary proposals also are not of much importance. The two things most required for a revival in the sphere of new work are cheaper money and an amendment of the Light Railways Act. We should then see more activity in the construction of interurban electric lines.

* * *

In connection with operation, the amount of business done on most systems continues to increase, but net profits are not responding so satisfactorily as they ought. Wages tend to rise, but the process of reducing fares has been checked—in some places so effectively that better results may be hoped for. The two

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subjects which have been most discussed by those concerned in tramway operation and engineering are rail corrugation and braking of cars on gradients. Some advance of knowledge is observable regarding both these subjects, but more remains to be discovered, and Rome was not built in a day.

The Halifax Accident. Two or three points of first-class importance emerge from the report of the Board of Trade regarding the late tramway accident in Halifax, when five lives were lost owing to a car running away backwards down a steep hill. The original circumstance which made a runaway possible was the failure of the current, arising from a circuit-breaker opening at the power-station. The car was in the process of climbing the hill at the time, and on the power disappearing a run-back at once began. The hand brake appears to have been ineffective, and, apart from it, the reason why the car was allowed to gather speed was, that the electric brake was not properly applied. This again largely arose from the fact that some of the Halifax cars are fitted with one arrangement of electric braking, and some with another. For the express purpose of preventing run-backs, some of the cars have had modifications made in the controllers and wiring, and in the case of these controllers a different set of movements of the handles is required for braking purposes from those necessary in the case of the ordinary controller. Prominently to distinguish the one type of control from the other, a large B is painted on the case in front of the driver's eyes. But, in the moment of emergency, the driver tried to apply the electric brake in the old way, though it was one of the new type of controllers that he had. Thus, no braking effect was produced. The lesson from this is that all controllers and braking arrangements should be identical on every car on any given system of tramways. When a man is accustomed always to apply a brake by a certain movement, or set of movements, he may be trusted to execute these movements—almost semi-automatically, it may be said—when the moment of emergency, or even of terror, arises. But if he works sometimes with one system of control and sometimes with another, there is great risk, as in this case, that the wrong set of movements will be made, and, even if the driver discovers and tries to correct his mistake, the car has by that time gained high speed.

* * *

Another point, and one which is emphasised by the Board of Trade inspector, is the necessity for slipper brakes being of such a design that they can be applied instantaneously. In this Halifax case, the slipper brake was applied after the driver found his attempt at electric braking was useless. The car, however, was now running fast, and its speed was still further increased before the slipper brake could be fully applied. This brake is put on by means of a screw, and it requires several seconds to screw it firmly down. It has been demonstrated that once a car has exceeded a certain speed down a steep gradient, the mechanical slipper brake has little effect. But if this brake is applied in the earlier stages it is very powerful. Hence the necessity for instantaneous application. The inspector's remark as to the efficiency of compressed air for the purpose may lead to further experiments in that direction. The objections to compressed air in the way of complication and cost may be overcome. An alternative would be the magnetic track brake, so designed as to be also capable of instantaneous application mechanically. The reports of the committees now considering the question of braking ought soon to be available, and it may be hoped that the Board of Trade report on the Halifax case will come within the purview of these reports.

Electric Railway Fares. There is room for some doubt whether the changes carried out during the past few weeks in regard to fares on the underground electric railways in London will lead to very much immediate increase of revenue. On a number of the routes the fares for the shorter journeys have been increased, this being rendered possible by an agreement with competing omnibus companies. If the number of passengers does not fall off, the increases in fares, while too small to make any material hardship to the individual passenger, will materially increase the gross revenue. In any case, there will be less of that too familiar operation of carrying passengers either at a loss or without appreciable profit. On the other hand, the system of through bookings

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between one railway and another is being extended. In some cases this does not mean any reduction in fare, but in others it does, the through fare being a little less than the sum of the separate fares was. In this direction the benefit from increasing short-distance fares on any one railway may be partly neutralised. The convenience to the public arising from the abolition of re-booking at interchange stations is, however, so great, that a considerable increase of passengers may reasonably be looked for. Only time can show what the relative effects of these different influences may be.

Allowance for Depreciation.

With the year 1908 a number of tramway undertakings complete the first decade of their existence, and from now onwards, it is to be expected that the already much-discussed question of depreciation will demand more and more urgent attention. To no class of persons is this matter of so much importance as to those who have invested their money in the companies which have embarked in the supply of this particular public service, and it is to be feared that many will be losers by the inadequate estimate originally made, by the promoters of these enterprises, of the amounts it would be necessary to set aside for this purpose. The growing sense of what may be required is to some extent reflected in the figures given in the Records of Electric Tramway Accounts published from time to time in our pages.

* * *

In 1904 the average provision, in the aggregate, for depreciation, by those towns having a combined station for lighting and traction purposes, was ·76d. per car mile, while for those having a separate generating station the average was ·66d. per car mile. In 1905 the corresponding figures were ·75d. and ·85d., registering a partial decline, for which, however, the large towns were chiefly to blame. But the accounts for the year 1906 showed the growing tendency by a marked change, the average figures being ·786d. for the first group, and 1·01d. for the second group. When the accounts for 1907 are available, it is probable that the average provision for depreciation will be found to be even further increased. No corresponding advance can be detected from the tables given of actual expenditure on maintenance and repairs, which have in each of the three years closely approximated to an aggregate of one penny per car mile for all the towns whose accounts are included. This is because the opening of new track has been fairly continuous during the period, and the increasing expenditure on the older tracks has in this way been disguised.

* * *

In addition to the depreciation of the plant and structure of a tramway, which is all that is contemplated in the provisions among corporate undertakings thus examined, the companies must allow depreciation of another kind. There are few companies owning tramways that have not to expect the determination of their ownership at some date more or less definite and not very remote. This involves the amortisation of all expenditure which from its nature is not likely to be recoverable at that juncture. All cost of forming the company and obtaining the concession, including street improvements undertaken with the latter object, are comprised under this head, and investors should take note while there is yet time, of the manner in which these contingencies are being provided for.

Tramway Signalling.

Useful information will be found in the present issue in regard to various systems of signalling used on tramways. This is a subject likely to be of more widespread importance in the future than it has been in the past. The large urban systems of tramways upon which attention has hitherto been so largely concentrated, consist for the most part of double track, and any system of signalling is accordingly unnecessary. But the future extensions of suburban and interurban light railways and tramways will probably consist very largely of single track with passing places, and it is on such lines that systems of signalling will be largely required. By an efficient system of the sort it is possible on routes of small traffic to have the passing places comparatively far apart, and annoyance and delay from cars meeting on single track are prevented. Even where the passing places are nearer one another, and the traffic heavier, a signalling system enables the cars to be worked more rapidly and economically, while more of them can be run without confusion.

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CORRESPONDENCE.

The Sandberg Rail.

To the Editor of The Tramway and Railway World.

Sir—The article on the Sandberg rail in your issue of December 5 has much interested me, in connection with Mr. Sandberg's valuable hints given to the Institution Conference on June 19 last.

I have been for several years increasing the silicon in my tramrail specifications, but have had considerable difficulty to contend with in the inert conservatism of consumers, manufacturers, and engineers; and I greatly rejoice to see such a distinguished authority as Mr. Sandberg taking the matter in hand.

Some little time ago, however, I was fortunate enough to possess the confidence of some enterprising clients, and I made them a specification which I reckoned, as it turned out rightly, would produce a better tramrail than was then known in this country, and which, before the completion of the order, I improved upon.

I give below some extracts from my test sheets for this work, which in every way support Mr. Sandberg's results:

	Weight, lb. per yard.	Drop Tests. 3 ft. 6 in. Bearings. Deflection 1st blow, inches.	Drop Tests. 10 ft. tons. Deflection 2nd blow, inches.	Tensile Tests. Breaking Tension, tons per sq. in.	Tensile Tests. Elongation on 8 in.	Impression 30 Tons Load. Depth in m/m.
Lot 1—Sample	85	1 1/4	-- 1/8	48·0	14·5	2·08
" Average		1 7/16	— 1/4	47·0	14·8	2·12
Lot 2—Sample	93	1 5/16	— 1/4	50·7	15·7	2·24
" Average		1 3/32	— 1/4	49·4	14·5	2·40
Lot 3—Sample	93	1 3/32	— 1/4	51·4	14·0	2·18
" Average		1 1/8	— 1/4	50·0	14·6	2·15
Lot 4—Sample	93	1 1/16	— 1/8	54·0	13·0	1·84
" Average		1 1/8	— 1/4	50·1	15·1	2·06
Lot 5—Sample	93	1 5/32	— 1/8	51·6	15·1	2·30
" "		31/32	— 1/8	51·6	13·8	2·08
" Average		1·04	— 1/8	50·7	14·3	2·24
Lot 6—Sample	91	1 1/8	— 1/2	51·6	14·0	2·04
" Average		1 1/8	--	50·1	14·3	2·16

For comparison with Mr. Sandberg's results quoted by you, it is necessary to make certain observations.

Drop Test.—Mr. Sandberg does not give the length of his test piece; mine was 5 ft., on 3 ft. 6 in. centres, as his; my blow was only 10 foot-tons instead of 18; but on the other hand Mr. Sandberg's rail weighed 111 lbs. per yard; and though he does not give the moment of inertia of his section, its ratio to mine, to judge by modern tendencies in design, would be considerably greater than the ratio of the weights, so that I do not think my deflection would compare unfavourably with his. My second blow was delivered on the reversed rail, and the negative deflection denoted the final deflection in the sense contrary to that given by the first blow.

Elongations.—Mine were taken on 8 in. lengths, and if reduced on 2 or 4 in. lengths would give results exceeding those you quote.

Tensile Tests.—I have given the best samples from each lot to show what the nature of the material was capable of; and also the average results for each lot, showing what is to be expected from manufacturing art. If Mr. Sandberg's result is an average, it beats mine in this respect; but, if it is a picked sample, it is not quite equal to mine. I should add that all these tensile pieces showed a distinctly fibrous texture at fracture.

Impression Test.—My ball was of the same size as Mr. Sandberg's, but my weight was reduced to 30 tons, for reasons which are irrelevant here. If the impression depth you give is reduced proportionally (taking cup surface distribution as recommended by Brinell) your impression depth would be 2·37 mm., which shows a little softer than mine.

I thought at the time that the fourth and fifth lots were the best I could produce; but subsequent observations have convinced me that I can better these, and I have prepared another specification, by which I expect to bring my mean results up to the best of those samples. I believe, however, that these rails have never shown corrugations.

I am just now making some experiments to see if I can get a better specification on these lines for bridge steel. But, of course, the problem is altogether a different one from tramrails. I have, however, attained some encouraging results, and hope to assure them by further experiments.

I am, Sir,
Your obedient servant,
53, Victoria Street, S.W. John H. Blakesley.

Dear Sir,—I have read with interest your editorial comment in the December issue *re* rail corrugations with Sandberg rails, and note that Sandberg rails on the District Railway have corrugated in three months' time, the process not being quite so rapid as with ordinary rails as expected. This is a considerable setback to those who favoured the theory that harder rails would prevent corrugations.

Taking the extra wear at 30 per cent., less 10 per cent. extra cost of manufacture, less the extra wear on tyres not yet reckoned with, there seems very little in favour of harder rails, especially when you consider the statement that neither Sandberg rails nor any other expedient has been found capable of preventing corrugations on the District Railway. This brings us back to my last letter in your November issue, "Why not deal with the cause instead of the result of a cause; surely prevention is better than cure."

Your paragraph *re* the rolling stock of the tube railways being identical should read, identical to the eye, but somewhat different, as proved by Parliament and Board of Trade inquiries *re* broken axles and defective trucks on the District Railway. Hence corrugations on the District Railway and not on the other three tube railways mentioned, which have only been running a comparatively short time. Given time, the other three mentioned will have corrugations if special care is not bestowed upon the rolling stock, without reference to any particular method of track laying.

Yours truly,
Liverpool Overhead Railway, J. A. Panton.
December 24, 1907.

First Motor Cab Results.—The report of the General Motor Cab Company submitted to the first annual meeting on December 16, shows that in May last the total paid-up capital was £372,518. The authorised capital is £500,000. There had been a loss up to May of £9,682, but the profits since then have more than made good the debit balance, which arose when the operations were of a preliminary character. The average number of the company's cabs in service during the six months ended November 13 was 306. Mr. D. Dalziel, who presided at the meeting and moved the adoption of the report, said that since the closing of the accounts on May 13 last the board instructed the auditors of the company to prepare a balance-sheet for the six months ending November 13. The result was highly satisfactory. The average takings per cab per day during the whole of that period was £2 3s. 6d. thus exceeding the estimate set out in the original prospectus by 8s. 6d. per day. Five hundred cabs had been actually delivered, and the company were now beginning to receive deliveries of the second order of 500 Renault cabs. According to the duly audited balance-sheet the six months ended November 13 showed a net profit, with an average of only 306 cabs at work per day, of £41,887 9s. 10d. The directors had decided to declare an interim dividend at the rate of 7 per cent. per annum on the preferred ordinary shares for the six months ending November 13. After writing off the debit amount of last year amounting to £9,682 and the amount necessary for the payment of the interim dividend, there remained about £20,000.

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ELECTRICAL TRACTION:

AN ESSAY AND REVIEW.

BY W. M. M.

The relation between technical journalism and permanent technical literature is somewhat analogous to that between newspapers and history. The modern historian must needs make large use of the newspaper files, but unless he have a faculty for judicious selection, and the ability to make the material his own, and to fuse it into a connected narrative, his history will be little better than a newspaper scrap book; and just as there are many things in our newspapers, the omission of which we should resent, but which it would be absurd to reproduce in a history, so our technical newspapers must contain a mass of detail of only ephemeral interest, which is quite out of place in a text book, or even in a book of reference. When, for instance, the Great Northern and City Railway was first opened, it was probable that a good many engineers would be interested in the pattern of the collector shoes supplied to it by the B.T.-H., and the technical journals of the time were justified in giving illustrated descriptions of it; but now most people either know of it or don't want to know, and the few who belong to neither class can get the knowledge in more complete form from the makers themselves, the pages given to it with large-sized illustrations, in Messrs. Wilson and Lydall's two volume treatise on "Electrical Traction,"* may be taken as a sample of the things which might be omitted or condensed with advantage. But it is only a sample. The two volumes are crowded with minute detail in every part. No possible diligence could have made anyone personally acquainted with all this detail as a matter of his own observation; its presence, whether desirable or no, marks the book as, very largely, a compilation, nor is it difficult, in most cases, for those familiar with the subject to trace the origin of the inspiration.

This is not necessarily to condemn the book. It removes it at once from the class of books to be read, but it may still find a high place amongst books of reference. The value of such works depends greatly on their indices, and, so far as I have been able to discover, these volumes are very perfectly indexed. They deal respectively with direct-current and alternating-current traction, and, therefore, it has proved convenient to have a separate index for each volume.

Nearly all technical books may be classified as either text books or books of reference, and there is a hint in the preface to this work that it is intended as a text book for advanced students. It is well to say "advanced." The tyro who should try to learn all about electrical traction from this book would need a vivid imagination to carry him from diagrams and illustrations to the practical realities they represent, and would be nearly driven mad by multiplicity of detail and deadly uniformity of style. The very iteration of the word "type" would haunt him, as "boots, boots, boots, boots, moving up and down again" got on the nerves of Kipling's South African recruit; but the advanced student would be sufficiently advanced to have discovered for himself that engineering is to be learned in the shops, not from books; and, like other readers, will use the book for reference as he requires it. Indeed, the description, "advanced student," should cover all readers, for the engineer who ceases to study soon drops out of the race.

A text book should deal mainly with principles, and should touch lightly on details, using them chiefly for purposes of illustration; should be orderly in arrangement, and should aim, as far as is possible, at securing the interest and attention of the reader. Messrs. Wilson aud Lydall just touch on the distinguishing features of the traction motor, and immediately plunge without further preface into calculation of performance curves, contriving to give the reader the impression, after making him wade through a barely intelligible résumé of Goldschmidt's method of obtaining the heating curve, that the labour has been spent almost in vain. There does not seem in this chapter to be any attempt at arrangement. The performance tests are followed by an official specification of the motor, in which the dimensions take the leading place, and the chapter winds up with a few casual remarks on lubrication. That matters little in an encyclopedia on traction, which one consults through the index for the section one wants, but it is clearly a disadvantage in a text book, even for advanced students. The first of the distinguishing features of the traction motor is stated to be "the motor is series wound." My first impression on reading this was, "Why, here are two men writing on electrical traction who have never heard of regenerative control." But I was quite wrong; the index directed me to some very good and detailed descriptions of both the Raworth and the Johnson-Lundell systems (the wording of which seemed strangely familiar), followed by a paragraph or two of guarded but not unfavourable criticism. It may be said that the authors in their preface expressly disclaim any direct advocacy of one system rather than another, questioning, indeed, the competence of any but a very few engineers to decide on such matters, and therefore their occasional departure from that self-denying rule is the more significant. It is almost a pity that they should have put such a restraint on themselves. Criticism is the salt of technical literature, but the greater the need, the greater the merit in abstaining from it.

The first edition of this book was published ten years ago, in one volume, and the advance in electric traction has been so great that the authors have found it necessary practically to re-write the whole. Still, some trace of the original may be discovered. On the very first page the reader is informed that "many traction systems are in operation," a sentence that seems almost grotesque in the present year. The first volume is divided fairly equally between tramways and railways, and is a very complete compilation, including even the Board of Trade regulations by way of appendix. The second volume is practically a separate book, having even the preface repeated. In its general outlines, in a complete devotion to facts that would delight the heart of Mr. Gradgrind, this volume is much on the same lines as the other. But there are other respects in which it differs. First, it deals wholly with railways, no one having yet attempted to run tramways on the alternate-current system. Secondly, its examples are drawn mainly from Continental experience, there being little to draw upon in America, and hardly any in this country, where polyphase railway work has never been allowed a chance, and single-phase has hardly passed the experimental stage. Thirdly, since the theory of alternating-current motors, whether polyphase or single phase with commutators, is more complex than that of the direct-current motor, the authors have conceded more to the student, and added two or three chapters of somewhat elementary theory to their storehouse of fact. In this volume, too, they are more free with their comment, weighing the respective advantages and disadvantages of polyphase, single-phase, and direct-current traction, with an evident leaning towards single-phase. To the polyphase system they may be suspected of doing less than justice, especially in their assumption of equality of weight in its equipment with that of direct current. Both volumes contain chapters on costs, and on financial considerations in respect of the change to

* "Electrical Traction," by Ernest Wilson and Francis Lydall, in two volumes. Edward Arnold, London, 1907. 15s. net each volume.

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electric working; matters usually outside the professorial range. The second volume is also more orderly in its arrangement, and comes nearer to being a book which it is possible to read than does the first.

There is a dreadful suggestion in the preface that the book is far from being complete; that specialists in each department of electrical traction will find imperfections there, to be compensated for by what they can gather in other departments less familiar to them. I trust this, like their reluctance to criticise, is only another proof of the authors' modesty. In a sense, of course, it must be true. In a book mainly descriptive, it would always be possible to find something else to describe—there is no mention of the conformity line, nor of Warner trucks nor tracks. But completeness in this sense is neither possible nor desirable. It would mean twenty volumes instead of two, and before they could be issued they would be out of date. The authors have given us of their best, the publishers have produced it in the best of type, with clear illustrations, and appropriately heavy paper and binding; and the Olivers who ask for more must indeed be insatiable. Traction men have never had anything quite like it before, and it were unreasonable to grumble at it because it is not something else, probably not nearly so useful.

NON-FOULING FLEXIBLE TROLLEY HEADS.

We have had brought under our notice two really ingenious and successful trolley heads, which should give relief to the much-worried tramway engineer and his assistants, inasmuch as the troubles arising from the frequent jumping and entanglement of present swivelling heads, also the enormous wear and tear of the overhead work and wheels by the fixed head, are claimed to be things of the past wherever the Holmes and Allen trolleys are in use. The Wellington, New Zealand, Corporation Tramways, have purchased the license to manufacture and use these heads on their

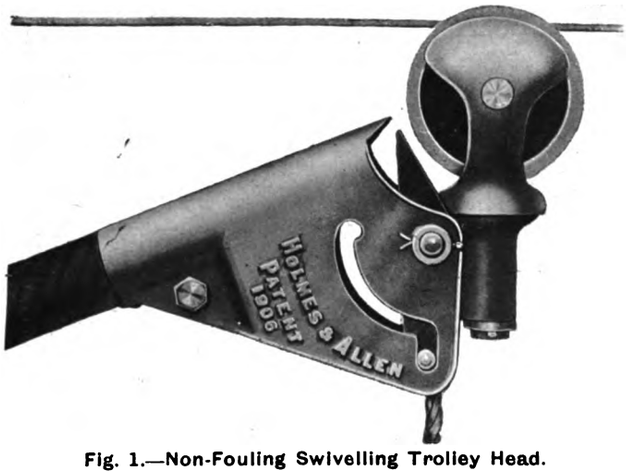

Fig. 1.—Non-Fouling Swivelling Trolley Head.

system, and the saving effected on fifty cars is calculated at about £1,000 per year. Nearly all the Australian systems also have Holmes and Allen trolleys running.

Mr. Garnet B. Holmes, one of the inventors and the senior partner of the firm, arrived last month in London, from Wellington, to carry on arrangements for the sale of their patent rights in the twenty-three different countries throughout which it is patented. While in America, he conducted numerous trials and was present at the Atlantic City Street Railway Convention where he had the opportunity of meeting every prominent tramway engineer in the United States, with the result that his invention became widely known and highly commended. So much has this been the case that, we are informed, enquiries are flowing in from every quarter asking for supplies.

Taking first the swivelling type (Fig. 1), it will be noticed that the socket which carries the fork spindle is not cast on to the pole piece, but it is on a separate bracket, which is mounted on a pin in the outer bracket, passing through a slot in the upper end of

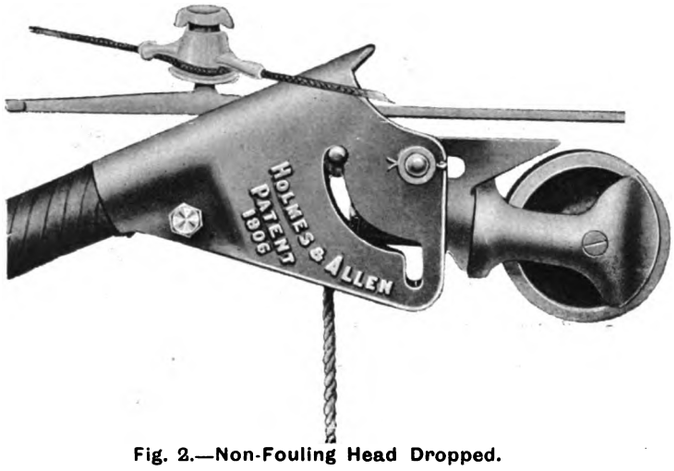

Fig. 2.—Non-Fouling Head Dropped.

this inner bracket, and a pin in the lower end engages the lower slot, enabling it to move up and down within certain limits. The pressure of the pole against the wire keeps the pin in the lower slot, while the spring in the head which tends to raise the pin in the slot, acts as a cushion and makes the upward movement of the wheel very lively, returning it instantaneously to the wire while passing irregularities, thereby preventing it from "jumping." Should it do so by any accident, however, then the spring within the head withdraws the lower pin, and the bracket carrying the foulable part instantaneously falls into an out-of-action position (Fig. 2.) The head then harmlessly passes under any kind of overhead work. Both the severe private and official trials and the actual everyday performance are cited as proofs of the efficacy of the device.

Fig. 3.—Flexible Under-Running Trolley Head.

Next taking the flexible under-running head (Fig. 3), engineers who are in favour of centre-running heads said that they liked the cushioning and swivelling action of the swivel head. This action has been applied to the ordinary harp and wheel by simply mounting the spindle on two blocks (in slots inclined downwards a few degrees) with buffer springs behind which normally tend to retain the blocks at the top of the slots, but which are compressed by the pole tension. When these springs are compressed the pressure is distributed equally on both, but should the wire be irregular, and tend to bind on either side of the wheel, the spring on the off side pushes the spindle forward and maintains the wheel in a straight line with the wire; in other words the wheel is said to be floating, or to have the same action as the radial truck. This allows of a reduction in the trolley pole tension, and with the swivelling action a saving put at £20 per car per year is easily effected, as the wear and tear of trolley wire, corrugation at ears, and frequent jumping of the trolley, are reduced to a minimum.

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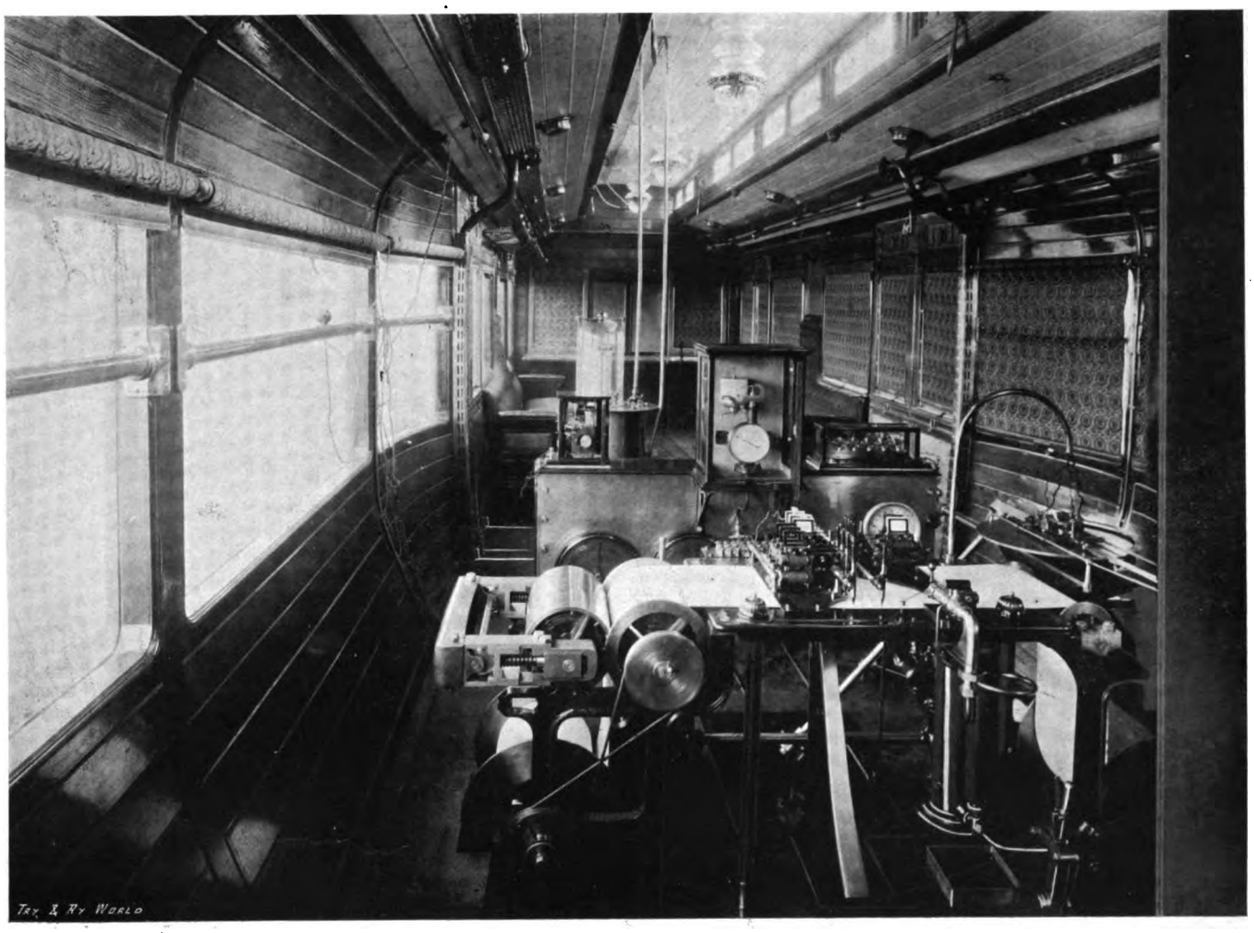
DYNAMOMETER CAR ON THE NORTH EASTERN RAILWAY.

We are indebted to Mr. Wilson Worsdell, chief mechanical engineer of the North Eastern Railway, for the following description and illustrations of a dynamometer car which he has designed for testing locomotives and rolling stock, with a view to obtaining data which would enable the company to meet the growing demands for greater speed and haulage, and generally to make for increased efficiency.

The body is built on a steel underframe, shaped to take a special spring which extends right across the middle of the carriage. This spring consists of thirty selected steel plates, each separated by rollers, so that there is a minimum of friction. The end of the spring adjacent to the drawbar is provided with rollers at each end of the span abutting against fixed faces, and from these the pull is transmitted to the train. As the function of this spring is to give an accurate measurement of the pull exerted on the drawbar, it was essential that the plates composing it should be of the highest quality, and that when buckled together they should be very carefully calibrated. Each plate was tested separately by being placed over supports and loaded until the specified deflection was reached, after which it was allowed to return to a horizontal position by unloading, or, failing in this, was rejected. A uniform rate of deflection was also required. After being put together the spring was carefully calibrated. A bracket which is fixed to the buckle projects inside the car, and as the spring is deflected the bracket moves a stylographic pen over a roll of paper, thus drawing a curve of drawbar pull. The paper is caused to travel over a table by drums driven by a measuring-wheel, which rolls on the rail, and which can be raised or lowered from within the car at will. This measuring-wheel is fitted with a very hard steel tyre to minimise wear, and accurately ground so that it makes a predetermined number of revolutions per mile. The paper can be made to run at varying speeds by changing the driving gear between the measuring-wheel and the drums. The speed of the train at any instant is shown in front of the operator by a pointer on a dial.

The permanent speed record is given by a pen in electrical communication with a clock, which thus makes a mark on the travelling roll of paper at two-second intervals. The speed can be read off from this by the aid of a special scale. There are eight of these electro-magnetic pens, which may be coupled up as required through a terminal board, and thus may be put in communication with any instrument. By the aid of connections at each end of the car external communication can also be made.



View of Instrument Table in Dynamometer Car.

The interior view, looking upon the instrument table, shows the electro-magnetic pens, and underneath the table may be seen the bracket extending from the spring buckle to the spindle on which the drawbar pen is fixed. On the front of the case on the far side of the instrument table are four dials which show the distance travelled, and above them, looking from left to right, can be seen the clock, boiler pressure recorder, and a meter for registering the work done.

The apparatus at the right side of the instrument table measures the work done, and is on the same principle as a planimeter. The horizontal circular plate moves a proportional distance to that of the

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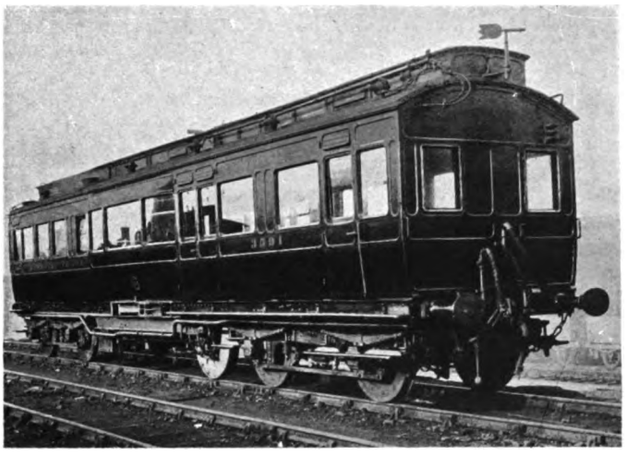
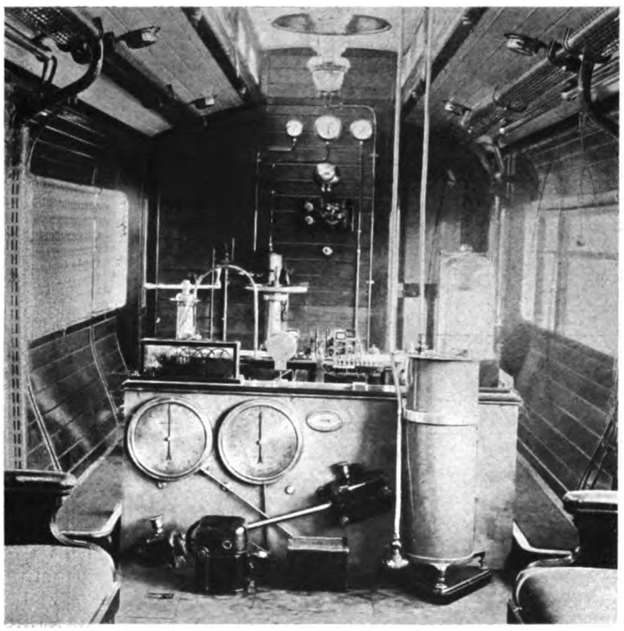
train, whilst a frame supporting a small wheel on edge moves across it from the centre, a distance proportional to the pull on the drawbar. Its revolutions are therefore a measure of the work done, and as it is in electrical communication with the previously mentioned meter, the work is recorded.

The indicator mounted on the near edge of the table is for recording the pressure in the steam chest. Owing to the fluctuating pressure in a locomotive steam chest



Exterior View of Dynamometer Car.

it was thought that the inertia of the long column of water in the connecting pipe would make the results worthless. Two indicators were therefore bracketed together with the pencils close to each other, and in the same horizontal line, so that they both marked on one common drum. One indicator was coupled direct to



Interior View from Front End.

the steam chest through a connection under 3 in. in length, whilst between the other indicator and steam chest, 60 ft. of bare copper pipe and an oil cylinder were interposed. It was found that the one in connection with the long pipe drew a line which was a mean of the pressure shown by the other, and this being suitable the apparatus was then installed as shown in the photograph.

The instrument behind the clock is for obtaining the velocity of the wind, which blows down a tube kept facing its direction, and causes the rise and fall of a pen on the paper drum. The view in the smaller photo. shows this more distinctly, whilst up in the roof a dial can be seen on which the direction of the wind is indicated. Two dials on which the drawbar pull and speed are shown are provided for the convenience of those persons who may be in the front end. Other auxiliary apparatus, such as pyrometers, draught gauges, etc., are included in the equipment, and indicators of a special type, with external springs and pencils controlled by electro-magnets, are employed on the front.

The external view shows the measuring-wheel previously mentioned. The wind vane, flexible pipes for boiler and steam chest pressures, and the plugs for external electrical connections may be seen at the front end. The spring can be seen, as the side protection plates have been taken off for the purpose of this photograph.

For brake tests a frame supporting three indicators can be fixed on the existing instrument table, and the pressures in the brake cylinder, auxiliary reservoir, and train pipe may thus be recorded. During locomotive experiments there will be recorded on the travelling roll of paper, the drawbar pull, work given out, speed, revolutions of driving wheels, steam chest pressure, and position of reversing lever. The effect that alteration in design has on any of these observations can readily be seen, and comparing the fuel and water consumption with the work given out, the total efficiency due to any change can easily be estimated. During experiments with rolling stock to determine tractive resistance, in addition to recording the drawbar pull and speed, the velocity and direction of the wind are also noted, so that comparisons can eventually be made with the variables eliminated.

The car is also of use in finding the sighting-point of a signal or the distances between two points, an electro-magnetic pen, in connection with a push worked by an observer, marking the positions on the travelling paper-roll. In a similar way, with the aid of the clock beating two seconds, the time lost by speed limitations can also be determined. In fact, any information likely to be of value in connection with locomotives and rolling stock can be obtained with this car.

Dumbarton Burgh and County Tramways Company.—This company has issued a prospectus inviting subscriptions for 75,000 six per cent. cumulative preference shares of £1 each (being the whole of the authorised preference capital) and 64,000 (out of a total authorised number of 80,000) ordinary shares of £1 each. The directors are Major C. Heaton-Ellis (chairman), Messrs. George Balfour, A.M.I.M.E., and Kenneth Sanderson, W.S. The prospectus stated that in 1904 and 1906 the Electric Supply Corporation were authorised to construct tramways from the termination of Glasgow Corporation tramways at Dalmuir, through Old Kilpatrick, Bowling, Dumbarton, Renton, Alexandria, etc., to Balloch, at the south end of Loch Lomond. The tramways in the burgh of Dumbarton have already been constructed by the Supply Corporation, and the other lines are to be constructed by this company. By the Dumbarton Burgh and County Tramways Order, 1907, the undertakings and powers were (with the exception of provisions relating to generating stations) transferred to this company, the company to take the electric energy required from the Supply Corporation's generating station. The tramways, when completed, will have a track length of 17 miles, over 13 miles of route. The population to be served (including that of Kilbowie and Clydebank) is about 80,000. The tramways will form, along with those of the Glasgow Corporation, a through route from Glasgow to Loch Lomond, and it is anticipated that large numbers of people will travel by tramway to the famous pleasure resort. A regular and increasing traffic is also anticipated between the towns on the route. Mr. George Balfour, managing director of the Dundee, Broughty Ferry and District Tramways Company, and a director of the Mansfield and District Tramways Company, who has been retained by this company as advising director for five years, estimates that the gross earnings of the tramways will be £32,500, and that the working expenses, including depreciation, should not exceed £18,500, leaving a net revenue of £14,000. £80,000 of debenture stock at 5 per cent. would absorb £4,000, and preference share dividend £4,500, leaving £5,500, equal to a dividend of nearly 7 per cent. on the ordinary shares.

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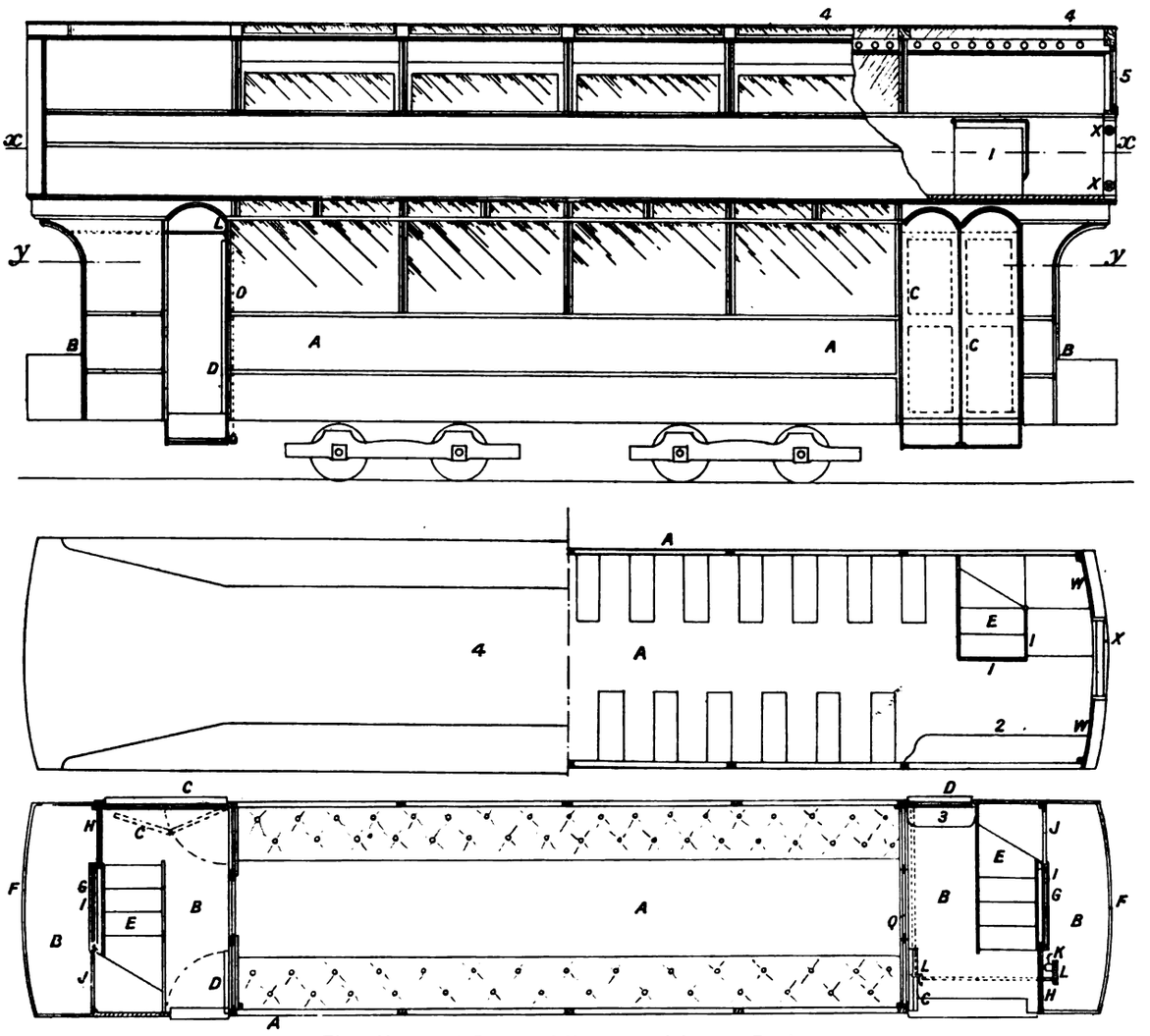
TRAMCAR IMPROVEMENTS.

A car that empties and fills simultaneously has long been a desideratum, but hitherto the difficulties in the way of adapting such a vehicle for street traffic have weighed so much with managers that the present type has remained in practically universal use. No one, of course, can have failed to note the confusion, the loss of time and temper, and even the danger arising at the "rush" hours of the day when passengers have to leave and enter by the same door. All this Mr. P. Kavanagh, of Liverpool, claims to have abolished by a car which not merely solves the main problem of providing separate entrance and exit, but also introduces a variety of other improvements.

So far as the general design of the car is concerned, Mr. Kavanagh has not departed in any radical sense from the existing two-deck type. By simply making the platforms a little longer than usual, he is enabled to give an entrance at the back, as at present, and an exit at the front. The great obstacle in the way of effecting this object lies, of course, in the fact that the safe side of the car in one direction becomes the dangerous side in the other. In the present design the difficulty has been removed by a series of contrivances which have been pronounced by tramway experts and others who have seen them to be not merely ingenious, but simple and capable of practical working. The entrances are provided with folding swing doors which open inwards, and opposite them on the other side of the car are hinged doors which serve for the exit of passengers. Nearly opposite the entrances are stairs leading to the top of the car, and between the stairs and the ends of the platforms are partitions which completely isolate the driver, the remainder of the platforms being open on all sides. These partitions are fitted with sliding glass doors, sliding windows to allow a current of air to pass through the car, and hinged doors leading to the space underneath the stairs, which space can be utilised for storage. The exit doors are preferably opened and closed from the driver's platform by means of handles operating through gearing a shaft which forms the hinge for the door. Owing to the platform being cut away at both the entrances and exits it is necessary—in some towns, at least, where there must be no projections from the car—to fill up these openings after the doors are closed. This is accomplished, in the case of the exits, by means of a hinged flap operated by a cord or wire attached to a sheave on a shaft, the other end being fixed to a swinging arm attached to the pivot of the flap; and, in the case of the entrances, by a plate provided with an extension, which is hinged so that when not required it is first turned on its edge and afterwards swung up on its hinge clear of the doorway.



Elevation and Plans of Upper and Lower Decks.

The isolation of the driver, the fact that the passengers under all circumstances enter and alight on the safe side, and the automatic contrivance which prevents any one from getting off until the car has come to a standstill all make for the safety of the public.

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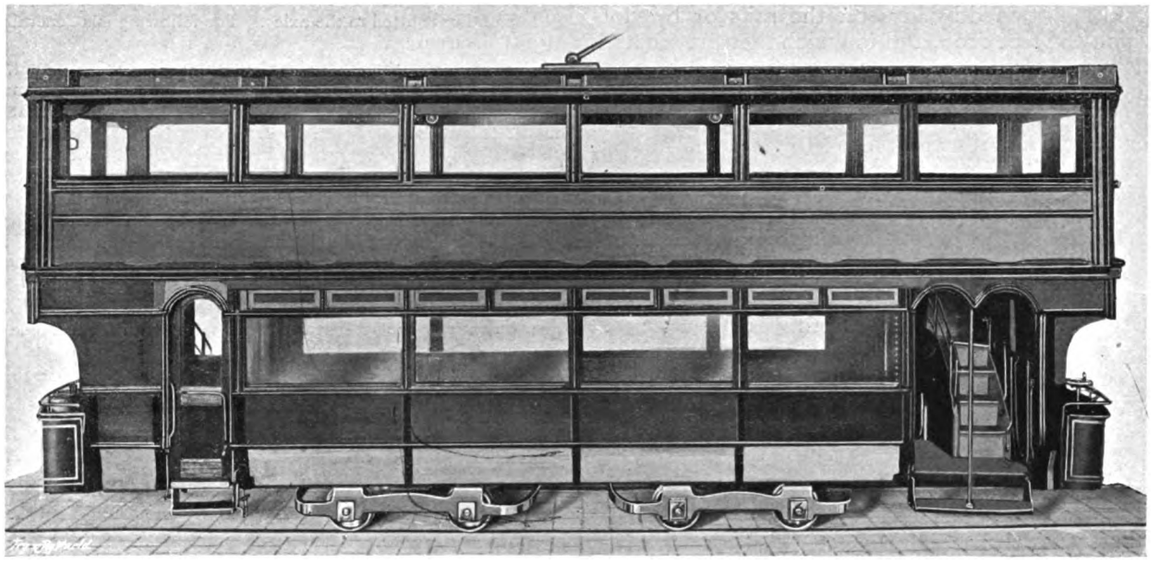
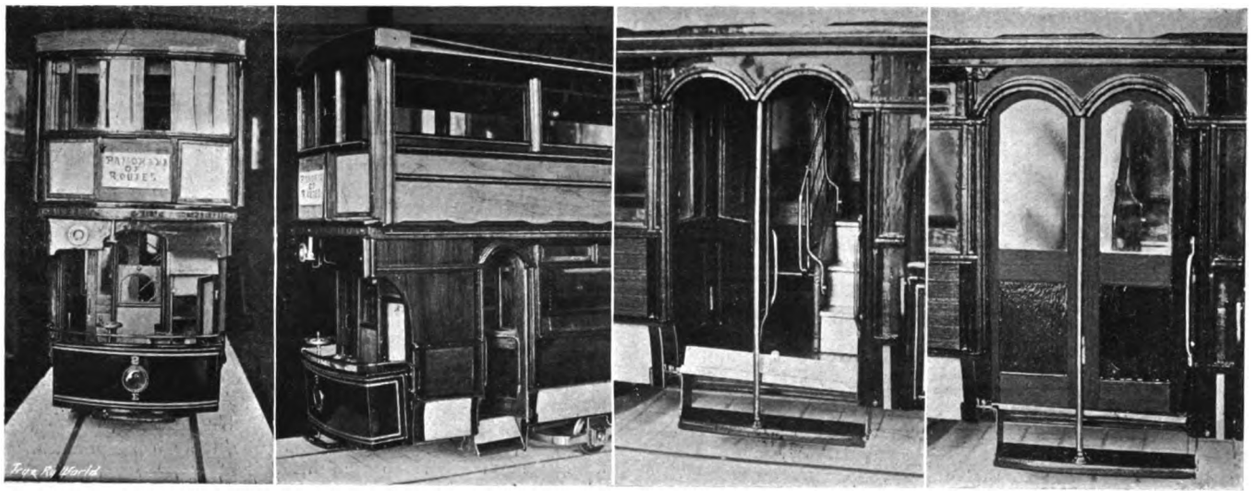
On the score of time-saving the inventor claims that by his improvement passengers will be dealt with so quickly that at least five minutes will be gained on each average town journey, and, of course, a correspondingly longer period on extended trips. Where the service requires improving, it can be done with the same number of cars as at present, and where it does not a reduction of rolling stock may be effected.

Of only less importance than the design which enables the car to fill and empty simultaneously is the arrangement of the top deck of the car. This is covered as at present, but the inventor dispenses with doors and closes the ends, partly by means of wood panelling and partly by glass, and he also utilises the centre wood panel space for exhibiting the destination of the car, and provides ventilators for the whole of the top. Moreover, at the top of the stairs is fixed a boarding or panelling, some of the remaining space on the overhanging platform being used for a seat fixed to the side and the end of the car. By closing up the ends and providing this seat, sitting accommodation is secured for more passengers than is possible with ordinary cars. In this connection it may also be mentioned that a removable seat for two persons is placed in position at the exit door below after the latter is closed, so that altogether here is a substantial addition to the holding capacity of the car. The seats in the two rows on the top deck are not opposite each other, but "staggered" so that more room is gained for getting into and out of the seats and for passing between them.



Model of Improved Tramcar.

Among the improvements to which Mr. Kavanagh's experiments have led him is one relating to the method of fixing the upper seats of tramcars, and it is of course equally applicable to other seats that are arranged in one or more rows behind one another, or side by side. Hitherto the iron feet of these seats have been fastened to the floor of the upper deck by screws, which, it is found in practice, frequently work loose. When one screw works loose others quickly follow, and when one foot of a seat is adrift the others also become loose in a short time, and the planking is so cut up that it is impossible to make a good repair without renewing it. As the planks generally run longitudinally it is necessary to remove several seats—sometimes all on one side of the car—to renew a defective or damaged plank. Mr. Kavanagh provides a pair of stout rails for each row of seats, and these are firmly bolted or screwed to the planking throughout their length. One or both of these may,



Views Showing New Arrangement of Exits and Entrances.

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if preferred, be countersunk, and they may each be made in one length along the top of the car, or, if desired, in two or more lengths. The feet of the seats are fastened by setscrews, bolts, or their equivalent, to these rails instead of direct to the floor, so that such strains as arise are distributed over the length of the rails instead of being concentrated under each seat foot as hitherto. With this extended bearing surface the life of the timber, it is claimed, will be much prolonged. The longitudinal position of the chairs may be indicated and maintained by lugs on the rails or by slots into which the feet drop, and in which they are secured. To renew a plank it is only necessary to undo the bolts that hold down the rails and to remove the seats *en masse*, instead of having to unscrew the far larger number of individual screws hitherto used. Moreover, one or more seats can be removed or renewed without disturbing the wood in any way. In some cases extra dummy bolt holes may be provided in the rails or their flanges, so that in case of some bolts working loose they may be put through fresh holes into sound timber beneath, which was impossible with seats fastened direct to the floor without altering their position.

In the large model in which he has embodied all these ideas, Mr. Kavanagh shows a car eminently practical in its working parts; and it can be readily seen that there would be no difficulty in adopting the chief improvements, at least, on existing rolling stock.

A NEW RADIAL TRUCK.

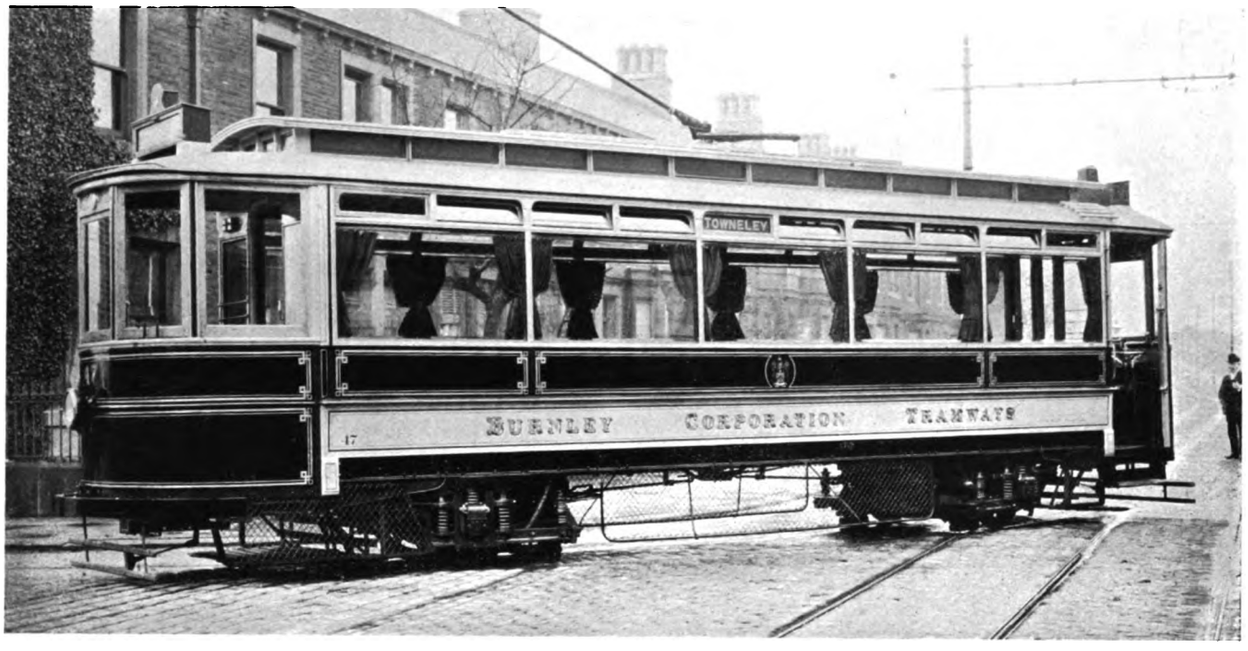
(*Contributed*)

A considerable amount of interest has been recently shown in the development of a type of truck, to which the name "radial" or "flexible wheel-base" truck has been assigned. The object of such trucks is to provide a longer wheel-base so as to afford greater support to the car body, and prevent the end oscillation so often noticeable in cars carried on the usual single trucks with wheel-base limited to 6 ft. Another object aimed at in the adoption of radial trucks, is the reduction of wear of wheels and rails when the cars are passing round curves. A number of forms of "radial" trucks have been constructed and put into operation with more or less satisfactory results. The nature of their design, however, limits their application to comparatively short wheel-bases, and, therefore, to short cars. A radial truck which may be regarded as a distinct advance on previous types has been recently constructed under the Simpson and Park patent, and has been running since September 10 on the Burnley Corporation Tramways with very satisfactory results.

As will be seen from the accompanying photograph, the wheel-base of the car is exceptionally long, the distance between wheels being 18 feet. This car is capable of easily passing round a curve of 25 to 30 ft. radius. The peculiar feature of the truck is the readiness with which the axles take up an approximately true radial position when passing round a curve.

This action is due to the design of truck in combination with a differential gear fitted to the axles. The following is a general description of the truck:

Two single axle trucks are used to support a car body, and, as each truck is entirely independent of the other, the wheel-base can be proportional to the length of the car. Each truck is pivoted at a point in the centre line of the axle, a king pin and bracket being attached to the car body underframe to take the drive. Between the car body and truck frame, rollers are interposed so as to reduce the friction and allow the car to radiate easily. The arrangements of springs is practically the same as on a Brill type maximum traction truck. The wheel brake blocks are hung as near the centre line of the wheel as possible. On the trucks in use at Burnley, a mechanically applied track brake is fitted and also a run-back-preventer on the axle, but a magnetic track brake can be arranged for if required. The differential gear on each axle is arranged in combination with the usual gearwheel, and is enclosed by the motor gear case. This gearing enables each wheel when passing round a curve to work independently of the other, and facilitates the movement of the truck into the correct radial position.



Burnley Car Mounted on New Radial Truck.

The following advantages are claimed for this truck:

(1) The position of the pivotal centre being over the centre line of the axle, as wide a range of angular movement as required can be obtained without danger of any part of the truck fouling the car body underframe.

(2) The length of the wheel-base can be proportioned to suit the length of the car, whatever this may be, there being practically no limit to length of wheel-base in this design.

(3) Wear between wheel flanges and rails and the tendency to unequal wear between the diameters of the two wheels on one axle is greatly reduced due to the differential action.

(4) Due to the use of the differential gear, the twisting strains on the axle are diminished.

(5) The weight of car is considerably less than one of similar capacity carried on 8 wheels.

(6) Less sand is required for accelerating and braking than would be necessary in the case of maximum traction trucks.

(7) There would be a reduction in current consumption and cost of maintenance as compared with a car designed to do the same service mounted either on maximum traction trucks or on equal wheel trucks with four motors.

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HALIFAX TRAMWAY MANAGEMENT.

A report of considerable interest was presented to Halifax Tramways Committee on November 29 by Mr. Charles F. Spencer, the chairman, and Mr. David Hanson, the vice-chairman. They had been asked to report on the organisation of the management of the system, in view of the resignation of the general manager and the rolling stock superintendent.

The report recommended that the office of general manager be combined with that of the electrical engineer, and that the following subordinate officers be appointed, viz., a traffic superintendent and a rolling stock superintendent. With regard to the first recommendation the report said it was obvious that the management of the electricity supply works should be in the hands of a skilled electrical engineer, and the duties of an electrical engineer were seldom carried out successfully unless he had received a mechanical training. An electrical engineer who had the desired qualifications would be the most competent officer to take complete control of all electrical and mechanical work. The commercial or traffic branch was a department which had its reflection in statistical returns, and needed little control from a general manager, who before he could alter any of the conditions was subject to the will of the Tramways Committee, who must direct matters of policy. Hence the departments for which a general manager was mostly needed were technical as distinguished from commercial. As to the traffic superintendent, a first-class man should be appointed. This office was of a commercial nature, and though a knowledge of mechanics and electricity might be of use it was not essential. The traffic superintendent would have to devote his attention solely to the regulation of traffic, so as to give the maximum facilities to the riding public with the least cost to the Corporation, and in such a manner as to ensure the best financial return. The rolling stock superintendent should be a practical mechanic and electrician combined, responsible to the general manager and engineer for the whole of the maintenance, mechanical and electrical, of cars. They recommended the appointment of Mr. Rogerson, the present electrical engineer, as general manager and engineer of the tramways and electricity supply departments. Mr. Rogerson, it was stated, had ample time to devote to the additional duties sought to be imposed on him; the two departments were interdependent, and the organisation could be so arranged as to work to the benefit of both departments. Mr. Rogerson had been consulted on the subject, and had been informed that if he was appointed the Committee would not be able to give him an advance of salary immediately, as he must first prove his worth. As to the traffic superintendent, the Committee were recommended to give a commencing salary of £250 per annum, with advances annually if satisfactory services were rendered, rising to a maximum of £350. The commencing salary of the rolling stock superintendent was recommended to be £130 per annum, rising to £160 providing he satisfied the Committee, and that he be allowed the house now occupied by the general manager free of rates, and rates only. A further recommendation was that the whole of the accountancy work be carried out under the direction of the borough accountant. This would necessitate the control of the cashiers, storekeepers, costs and accounts clerk, wages clerk, and traffic return clerks being transferred to the borough accountant's staff.

The report gave the salaries of the present chief tramway and electricity officials as follows: Electrical engineer, £600; tramways manager, £400; rolling stock superintendent, £117; rolling stock superintendent's clerk, £36; total, £1,153. The cost under the new scheme would be as follows: General manager of combined departments, £600; traffic manager, £250; rolling stock superintendent, £130; total, £980, or a saving of £173 on the present system of management. The recommendations were adopted by the Committee.

The Committee have also instructed the manager to place an additional employee on each car on the routes where the gradients are steepest. The manager has also been asked to see to the classification of routes and cars, and the appointment continuously of the same driver and conductor to one car, and to the equipment of the cars with 3 ft. 3 in. slipper brakes.

The recommendations of the Committee came before the Town Council at a meeting on December 4, when Mr. C. F. Spencer, chairman of the Committee, said the scheme would benefit the Corporation and the ratepayers. It was desirable that the confidence of the public in the tramways should be fully restored, and that the system should be placed on a sound basis.

Alderman Hey, ex-chairman of the Tramways Committee, moved that the proposals be referred back. He was in favour of one chief officer over the whole of the tramway undertaking, but he was opposed to the recommendation made by the Committee on that point. Mr. Rogerson, the electrical engineer, had had no experience in tramway work. No manager could make the Halifax tramways as successful as they ought to be unless the electric current could be supplied for the tramways at a reduced cost. There were many possibilities of huge mistakes in the scheme, and it was therefore advisable, he thought, that it should receive further consideration.

The Council by a large majority rejected the amendment, and adopted the proposals of the Tramways Committee.

LONDON COUNTY COUNCIL TRAMWAY MATTERS.

Extension of Electric Traction.

At a meeting of the London County Council on December 3, the Highways Committee formally reported that the reconstruction for electric traction on the conduit system of the tramways in Gray's Inn Road from Theobald's Road to Pentonville Road, in Goswell Road from Aldersgate terminus to City Road, and in Holloway Road from Highbury station to the Archway Tavern, together with the construction on the same system of traction of the new tramways from Grove Vale to Stuart Road, Peckham, had been completed. The lines had been inspected on behalf of the Board of Trade and certified. Electric car services were instituted on the Goswell Road line on November 27, and the Grove Vale to Peckham line was opened for public traffic on November 28. On the same day a few electric cars commenced running on the Holloway Road line, and the service would be increased as soon as possible. Electric car service would be instituted along Gray's Inn Road on December 5.

Price of Brake Shoes and Horse Shoes.

The committee had considered tenders for the supply of brake shoes and horse shoes required for the tramways department, and had accepted the most favourable tenders, namely, that of William Pease and Company, for the supply of brake shoes at £4 15s. a ton; and that of William Cooke and Company, for the supply of horse shoes at £10 10s. and £11 10s. a ton. The expenditure would be charged to revenue.

Medical Examination of Motormen.

The adjourned reports of the Highways Committee on this subject were adopted without debate. This no doubt arose from the fact that, at a largely attended meeting of the men held on Sunday morning, December 1, it was resolved, on the advice of the Amalgamated Association of Tramway and Vehicle Workers, to accept the modified form of medical examination and the assurance of continued employment as proposed in the later reports of the Highways Committee on the subject.

New Construction.

The proposals for extending existing contracts so as to cover work and plant for the new lines from Hammersmith to Harlesden and from Wickham Lane, Plumstead, to Abbey Wood, which had been postponed from a previous meeting, were confirmed. Capital votes of £40,000 were passed in connection with the work.

Workmen's Fares.

Alderman Thompson, replying to questions, said that the Highways Committee were not in a position to advise the Council to extend the facilities for workmen's fares, as that would entail a large loss to the undertaking by dislodging passengers already paying full fares.

Aldgate to Bow Tramways.

At the meeting of the Council on December 10,

The Highways Committee pointed out that the Council, on July 23 last, had decided to accept an offer of the G.B. Surface Contact Company to supply and fix for £3,360, surface-contact equipments for 48 electric cars to be used on the Aldgate to Bow route. The company declined to enter into a contract in the form which the Committee desired, but, after negotiations, a form had been agreed to which provided that the fixing of the equipment on the cars should be done by the tramways department under the supervision of the company. This arrangement would involve additional expenditure of about £250, but it would materially expedite the completion of the work.

The proposal was agreed to.

Excess Votes for Working Expenses.

The Committee drew attention to the fact that in certain instances working expenses had exceeded the annual maintenance votes for the year 1906-7. Among the items of excess was £12,516 for repairs, of which £10,000 was accounted for by permanent way repairs in excess of the estimate, and consequent on the cost of anchoring rails, new curves, and extra paving works. The horsing expenses had exceeded the estimate by £31,683, of which £19,000 was in respect of increased cost of forage. The total excesses amounted to £59,376, but they were to a large extent counterbalanced by savings under other heads of estimates, so that the expenditure as a whole exeeeded the estimates by only £8,388. The Finance Committee, reporting on the subject, stated that to a large extent both excesses and savings appeared to be due to the fact that the opening of certain lines reconstructed for electric traction took place later than had been assumed.

Removal of Sludge from Conduits.

The Council approved new contracts for the removal of sludge from the conduits, depôts, etc., of the tramways for twelve months. For the southern lines the contract was with Samuel West, Limited, at 2s. 10d. a cubic yard, and for the northern lines it was with Mr. Henry Crane, at 2s. 4d. a cubic yard.

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Plough Equipment Contracts.

It was reported that the Highways Committee had considered tenders for the supply of 600 rubber plough bases, and 1,200 plough leads, and had accepted the lowest tender, namely, that of the India-Rubber, Gutta-Percha, and Telegraph Works Company, at 56s. for each plough base, and 4s. 3d. for each plough lead.

The Tramway Subway.

The Committee reported that arrangements should now be made for the construction of the tramways in the extension of the tramway subway from the Strand to the Victoria Embankment. The estimated cost of the work, including £760 for rails, was £10,000. No extra cables, cable ducts, rolling stock, or other plant would be required, and the Committee proposed that the tramway works should be carried out by the Works Committee as an addition to their subway construction work, and that operations should begin as soon as possible. The track rails would be obtained under a contract for rails shortly to be entered into. Ordinary slot rails would not be required, and sufficient conductor rails were already provided for, but an additional cross-over would be needed, which it was proposed should be obtained from Hadfield's Steel Foundry Company at the present contract rates.

Consideration was postponed, under standing orders, and at the meeting on December 17 the report was adopted.

Caledonian Road and Seven Sisters' Road Tramways.

At the meeting of the Council on December 17 the Highways Committee reported their proposals for expediting the reconstruction of these tramways for electric traction, so as to avoid the sandwiching of horse and electric cars on the Holloway Road route. The total length of the route was 2¾ miles, and the estimated cost of reconstruction and equipment on the conduit system was as follows:

	£
Trackwork, etc., including special work and £12,900 for rails ...	100,700
Alterations of bridges	5,000
Cables, cable ducts, feeder pillars, etc....	9,120
Sub-station plant, switch gear, etc.	2,200
Rolling stock	16,150
Total	£133,170

No further buildings nor additional cable ducts would be required. The Committee proposed to invite tenders for the other work. It was proposed to extend existing contracts with Hadfield's Steel Foundry Company and J. E. Spagnoletti, by approximately £4,000 and £200 respectively, for special track work and additional low-tension switchboards.

The following tenders had been received from selected firms for the supply of an additional motor generator, which would be required:

	£
The General Electric Co.	1,608
The Electric Construction Co.	1,645
The British Westinghouse Co.	1,733
Dick, Kerr and Co.	1,780

It was recommended that the lowest tender should be accepted, and that the General Electric Company should be allowed to sub-let to E. F. Moy, Limited, the supply of the main rheostat required for the motor generator.

The Finance Committee concurred as to the desirableness from the financial point of view of these lines being reconstructed at once.

The proposals were approved.

Hammersmith to Harlesden Tramways.

The Committee reported that they had considered the following tenders for the road work and plate-laying, exclusive of rails and special work, for the construction on the overhead system of tramways from Hammersmith to Harlesden, and certain paving works for street widenings. The total length of line was about 6¼ miles single track.

	Tramway Works.			Paving Works for Street Widenings.			Total.		
	£	s.	d.	£	s.	d.	£	s.	d.
George Wimpey and Co.	32,685	10	3	6,392	12	11	39,078	3	2
Dick, Kerr and Co.	33,814	7	10	6,338	19	0	40,153	6	10
George Hay and Co.	33,936	14	4	6,443	8	1	40,380	2	5
W. Manders	34,381	16	10	6,235	13	8	40,617	10	6
W. Underwood and Bro.	36,694	7	11	6,142	19	11	42,837	7	10
George Law	34,332	13	6	8,560	8	4	42,890	6	10
R. W. Blackwell and Co.	36,577	8	4	6,772	13	6	43,350	1	10
John Mowlem and Co.	40,164	1	4	6,229	6	5	46,393	7	9
W. Griffiths and Co.	39,536	8	7	6,898	7	2	46,434	15	9
National Electric Construction Co.	39,170	15	18	7,416	16	2	46,587	12	0
Edmund Nuttall and Co.	40,472	19	10	6,530	9	1	47,003	8	11
J. G. White and Co.	41,751	16	0	7,284	14	10	49,036	10	10
Fry Bros.	41,434	10	7	8,656	14	9	50,091	5	4
W. Muirhead and Co.	43,318	1	10	8,304	0	11	51,622	2	9
J. Moran and Son	45,962	1	0	7,899	10	6	53,861	11	6

The chief engineer's estimates were £39,839 11s. 8d. for tramway works, and £7,567 12s. 2d. for street improvement works, or a total of £47,407 3s. 10d. The Committee proposed that the lowest tender, namely, that of G. Wimpey and Company, should be accepted for the execution of the tramway works, and that the firm should be allowed to sub-let to the undermentioned firms the following portions of the work: (1) Bayliss, Jones and Bayliss, tie bars and bolts; (2) J. B. Lee and Son, creosoted deal blocks. The Improvements Committee were not yet in a position to report on the tenders for street paving works outside the tramway tracks.

Tenders had been invited from three selected firms for the special track-work required for these tramways, and the following offers had been received:

	£	s.	d.
Hadfield's Steel Foundry Co.	1,666	12	6
Edgar Allen and Co.	1,773	0	0

The chief engineer's estimate was £1,650 5s. 0d. The committee proposed that Hadfield's tender should be accepted.

The tenders recommended were accepted.

Supply of Track Rails.

The following tenders had been considered for the supply of about 1,520 tons of track rails and fastenings for the Hammersmith to Harlesden tramways:

	£	s.	d.
Walter Scott, Ltd.	11,546	0	0
Bolckow, Vaughan, and Co., Ltd.	12,893	0	0
P. and W. MacLellan, Ltd.	13,119	18	9
Barrow Haematite Steel Co.	13,262	12	6
Lorain Steel Co.	14,207	10	6
	(Not to specification.)		
Steel, Peech, and Tozer, Ltd.	14,444	10	0
Cammell, Laird, and Co.	15,579	10	0

An incomplete tender had also been received from the Continuous Rail Joint Company of Great Britain. The chief engineer's estimate was £12,137. The specification had stipulated that the rails should be of British manufacture, and the tenderers had been asked to state whether any reduction would be made in the prices in the event of the quantity being increased to about 2,500 tons, so that the rails required for the Aldwych to Victoria Embankment, and the Caledonian Road and Seven Sisters Road tramways might be included. The Committee recommended acceptance of the lowest tender, and that the contract should also include the additional rails, amounting to about 1,080 tons, above referred to. The company were prepared to supply the additional quantity at the same price as those in the tender. The effect of this addition would be to increase the expenditure to £19,691. It was further proposed that Walter Scott, Limited, should be allowed to sub-let to the undermentioned firms the following portions of the work: (1) Coghlan Steel and Iron Company, fishplates; (2) Guest, Keen, and Nettlefolds, bolts and lock nuts.

On the proposal being submitted,

Sir John Benn complained that conditions for British manufacture were put into the advertisements without the Council being consulted. He said that this condition meant putting an increased cost on the ratepayers of 10 per cent., and the Committee might soon find itself faced with a ring of British contractors.

Mr. Hunt said that Belgian rails gave 10 or 15 per cent. less value for money than English rails.

Alderman Thompson said that the Committee were following the example of former Committees.

Sir John Benn replied that the Highways Committee in the past were staggered with the prices for British rails. They sent an order to Belgium, with the result that the prices fell greatly.

Eventually the tenders as received were accepted.

Supply of Flat-bottomed Rails.

The following offers had been received for the supply of about 136 tons of flat-bottomed rails and fastenings for the Bow, Hammersmith, and Hackney car sheds:

	£	s.	d.
P. & W. MacLellan, Ltd.	1,072	18	0
Bolckow, Vaughan, and Co., Ltd.	1,081	15	0
Barrow Haematite Steel Co.	1,084	4	9
Steel, Peech, and Tozer, Ltd.	1,134	16	10
Walter Scott, Ltd.	1,135	6	3
Cammell, Laird, and Co.	1,262	0	0

The Committee recommended acceptance of the lowest tender, that of P. and W. MacLellan, and that that firm should be allowed to sub-let to the undermentioned the following portions of the work: (1) Barrow Haematite Steel Company, rails; (2) Guest, Keen, and Nettlefolds, bolts and nuts.

This course was adopted.

Car Under-Frames.

The following were tenders received for the supply of steel under-frames for the 50 tramcar bodies which were being manufactured by the tramway department.

	£	s.
Hurst, Nelson, and Co., Ltd.	1,975	0
Heenan and Froude, Ltd.	2,150	0
G. R. Turner, Ltd.	2,275	0
De Bergue and Co., Ltd.	2,287	10
United Electric Car Co., Ltd.	2,300	0
Mountain & Gibson, Ltd.	2,402	10

After the tenders were opened a communication was received from De Bergue and Company, stating that, owing to a clerical error, the price quoted in their tender should have been £38 15s. each under-frame, or a total of £1,937 10s. Under the circumstances the Committee had not felt able to consider the altered price. They recommended that the lowest of the tenders as received, namely, that

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of Hurst, Nelson, and Company, should be accepted, and that the firm should be allowed to sub-let to such firms as might be approved by the chief officer, the supply of steel castings, steel plates, bars, angles, etc., and malleable iron castings.

The recommendation was adopted.

REPAIRS TO SUB-STATION MACHINERY.

Two motor generators supplied by Dick, Kerr and Company had been considerably over-worked in Limehouse sub-station, in consequence of the non-delivery of other motor generators by another firm. The over-worked machines needed considerable overhauling, and it was recommended that the offer of Dick, Kerr and Company, to undertake the necessary repairs for £700, should be accepted, and this the Council agreed to.

RESIGNATION OF ROLLING STOCK SUPERINTENDENT.

The Committee regretted to report that Mr. J. Bowden, who was appointed on July 26, 1904, as rolling stock superintendent, had resigned his position to take up another appointment. The Committee were of opinion that Mr. W. E. Ireland, assistant rolling stock superintendent, whose present salary was £250 a year, should be promoted to fill the position when vacated by Mr. Bowden at the end of February. Mr. Ireland was fully capable of carrying out the duties, and the Committee proposed that his salary should be increased to £400 a year. It was further proposed that applications should be invited by advertisement for the appointment of an assistant rolling stock superintendent at £250.

The course proposed was approved.

ANNUAL SUPPLY OF CABLE.

The Committee had accepted a tender by the British Insulated and Helsby Cables, Limited, amounting to £428 10s., for the supply of lead-covered cable for the year.

COST OF STREET WIDENING.

A long debate took place on a proposal by the Improvements Committee to debit the tramways account with half the cost of widening a portion of Old Street, estimated at £3,000. Sir JOHN BENN alleged that this was the beginning of an attempt to strangle the municipal tramway undertaking, but this was indignantly denied by Mr. R. A. ROBINSON, on behalf of the Moderate party, who contended this was a fair and proper charge to place upon the tramway undertaking. The London County Council tramways, he said, could not be strangled if anyone wanted to. Ultimately, on a division, by 60 votes to 49, an amendment to refer back was defeated, and the resolution to make the charge in question was agreed to.

The meeting broke the record for length, as it lasted over twelve hours. The Council then adjourned till January 21 next.

Cost of a Bradford Accident.—The tramway accident which occurred some time ago at Church Bank, Bradford, has led to prolonged negotiations with the injured passengers. These are now completed, and it is announced that all claims have been settled for £2,000, plus doctors' fees. Fourteen persons were injured.

Carriage of Dogs on Cars.—Mr. T. B. Goodyer, general manager of Croydon Corporation Tramways, has received replies to queries respecting the carriage of dogs on cars from 83 tramway undertakings. From the tabulated return which he has prepared, it appears that in 29 cases no dogs are allowed, while in the remaining 54 towns they are permitted on the cars. In 30 of these instances dogs are only allowed outside, and in 15 they are permitted either outside or inside. In eight other instances only small dogs are allowed inside, large ones having to go on the roof. In the remaining case, dogs are only carried on the car platforms. In nearly all instances where dogs are carried no charge is made for them, but in a few cases ordinary fares are levied, while two or three towns make a uniform charge of a penny or twopence. In the case of 28 tramway systems the carriage of dogs is recommended, in a few no objection is made, and in the case of the rest it is not recommended. In many instances the dogs are carried at the conductor's discretion.

German Motor Car Industry.—The Berlin correspondent of the *Morning Post*, telegraphing on December 11, stated that a serious crisis, apparently owing to over-production, has overtaken the motor car industry in Germany, and in connection with it a meeting was held on December 10 at the Ministry of the Interior, which was attended by representatives of the Government, of leading German automobile clubs, and of motor car makers. The representative of the Government stated that the stagnation in the development of the motor car industry had induced the Government to institute inquiries with a view to ascertaining whether anything could be done on the part of the Imperial authorities to support the industry, and what means could be employed in order to find new markets for manufacturers. With this object the Imperial Office for Internal Affairs has drafted a series of questions which it is proposed to put to motor car manufacturers and to purveyors and manufacturers of rubber, benzine, car frames, and raw material. These questions are to be issued in January. By the express desire of the Government, the utmost secrecy is preserved concerning the nature of the questions.

DEPRECIATION ALLOWANCE AT CARDIFF.

At a meeting of Cardiff Tramways Committee on December 13, Mr. John Allcock, city treasurer and controller, presented a report on the subject of the depreciation allowances necessary to be provided for the tramway and lighting undertakings. As in Cardiff there is a separate generating station for the tramways, the portion of the report dealing with that undertaking is complete in itself. Slightly abridged, it is as follows:

I have been supplied by the city electrical engineer and manager with the rates of depreciation, which he considers represents fair wear and tear, based upon his expert knowledge of the condition of the Cardiff plant, and the undertaking generally. I have extracted the expenditure of the various sections of the work as shown by the following table, and against such cost I have calculated the annual amount of depreciation which is necessary, and in a further column the sinking fund, which has been set aside to redeem the loans which have been raised on those parts of the undertaking which are subject to depreciation:

Purpose.	Expenditure.	Depreciation.		Sinking Fund Instalment.	
		Per cent.	Amount.	Years	Amount.
	£		£		£
Track and bonding	209,369	5	10,468	30	4,225
Cars	79,602	12	7,960	15	4,202
Buildings	115,365	2½	2,884	30	2,328
Buildings	8,500	2½	212	25	230
Engines and generators	41,591	5	2,079	30	839
Engines and generators	22,500	5	1,125	25	597
Boilers, pumps, economisers	15,544	5	777	30	313
Boilers, pumps, economisers	6,350	5	317	25	168
Mechanical stokers and coal bunkers ...	1,736	5	86	30	35
Mechanical stokers and coal bunkers ...	2,550	5	127	25	67
Steam and other pipes	8,485	5	424	30	171
Steam and other pipes	6,374	5	318	25	169
Switchboards and instruments	5,933	7½	444	30	119
Tools, plant, etc.	4,268	7½	320	30	86
Conduits and cables...	53,957	3	1,618	30	1,088
	£382,124		£29,159		£14,637

	£	s.	d.
Annual depreciation as per foregoing table	29,159	0	0
Annual charge for sinking fund	14,637	0	0
Annual amount to be provided in addition to sinking fund	£14,522	0	0

NOTE.—Of this amount the Committee have already approved the provision of £5,500 as per resolution dated February 22, 1907, leaving a further annual sum of £9,022 still to be provided.

I recommend that the Committee approve the principle of setting aside as a depreciation fund the difference between the actual depreciation, based on the life of the several parts, and the sinking fund, which has been set aside in respect thereof.

The argument has been advanced that the Corporation, in addition to maintaining a sinking fund, should also provide for the full depreciation on their various undertakings, but I do not agree with this contention, as the outcome of such a practice would mean that the present generation would redeem the loans, and at the end of the time an amount equal to the whole of the capital invested would be in hand in addition, in the shape of a depreciation fund, notwithstanding the fact that the undertaking had been kept up to date as far as this was possible out of revenue. To provide sinking fund and full depreciation would inflict a double burden upon the present generation which I do not think fair, and I feel that if a certain amount is set aside each year, based upon the difference between the depreciation and the sinking fund, that the Corporation will have done all that can reasonably be expected.

The question of obsolescence of plant may in the future operate on the subject of depreciation, but, as a matter of fact, it is impossible to state with any degree of definiteness the liability which might accrue under this heading, as it entirely depends upon improvements in machinery, and also the introduction of labour-saving appliances, etc.

I recommend that the first payment to the fund be dealt with in the current year's accounts, and that the future profits be also transferred to depreciation funds until such time as the amount standing to the credit thereof equals the amount which should be in the fund. If in any year the profits should be insufficient to meet the charges recommended for depreciation, I suggest that such liability should be the first charge on future profits.

Mr. Arthur Ellis, city electrical engineer and manager, entirely agrees with the views expressed in this report.

The committee adopted the report.

A Demonstration.—On January 10, by the courtesy of the chairman of the Tramways Committee and the general manager of the West Ham Corporation Tramways, a demonstration of a car fitted with the Warner steering control (which has been described and illustrated in our pages) will be given at the Greengate depot, near Plaistow Station on the District Railway. Tickets may be obtained from the Secretary, The Warner Engineering Company, 11, Dartmouth Street, Westminster, London, S.W.

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THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

On December 4 a dinner in connection with the Tramways and Light Railways Association took place in Prince's Restaurant, Piccadilly, London. Prior to the dinner a number of the members, on the invitation of Mr. A. L. C. Fell, chief officer of the London County Council tramways, paid a visit to the Greenwich power-station, where the various sections of the plant and equipment were viewed with much interest. Three out of the four large 3,500 KW. units were in operation, and the visitors also found that the second portion of the station, which is to be equipped with steam turbines, is rapidly advancing. The whole of the electric tramways of the London County Council are now being worked from Greenwich, as the supply from outside sources for the last section of the lines to be so fed was discontinued on November 30.

At the dinner the chair was occupied by the President, the Duke of Argyle, K.T., and the gentlemen present included: The Earl of Kerry, Lord Vaux of Harrowden, Hon. Arthur Stanley, Sir R. Hunter, Sir H. Jekyll, Sir A. Kennedy, Sir R. Littler, Messrs. J. Aldworth, P. A. d'Alton, W. Anderson, O. H. Baldwin, R. S. Ball, A. N. Banister, A. L. Barber, A. H. Beatty, W. W. Beaumont, S. Beeton, E. Benedict, F. Bland, G. Bond, T. Browett, R. Brown, J. K. Bruce, J. Cater, F. Clay, G. Conaty, W. B. Cownie, E. Cummings, C. H. Dade, J. Devonshire, G. Devonshire, C. Durnford, E. J. Farmer, A. R. Fearnley, A. L. C. Fell, Fielding, G. Flett, E. Garcke, S. Garcke, E. T. Gatehouse, H. Godfray, F. E. de Guerrier, J. B. Hamilton, W. Harper, E. Hatton, W. H. Hawley, Heath, Hoare, T. Holliday, W. B. Hopkins, T. W. How, R. J. Howley, C. C. Hutchinson, W. Ivey, B. M. Jenkin, A. W. Jones, J. Kennedy, L. Macassey, A. McCallum, J. McGregor, C. W. Mallins, Richard Mayne, J. Millington, A. R. Monks, S. Morse, W. Morris, Junr., E. Munro, Kenric Murray, R. Murray, G. Offer, Pegler, Perry, W. Philipson, W. Phillips, F. F. Pilling, A. H. Pott, E. B. Read, G. Richardson, Richmond, J. H. Rider, J. Rodgers, Ronald, W. Rutherford, A. J. Salter, J. R. Salter, H. M. Sayers, H. Sayers, Ernest Schenk, H. Scholey, E. Sellon, S. Sellon, W. L. Shand, R. T. Simcock, J. A. J. Smith, Sydney Smith, R. A. Smithson, R. le Strange, R. Stutz, G. Trentham, Trimnell, G. Trube, A. de Turckheim, Turnbull, Walton, G. Warlow, W. Warlow, J. S. Warner, C. Cornwallis-West, A. G. White, A. M. Willcox, I. E. Winslow.

The PRESIDENT proposed the toast of "The Tramway Industry," and in doing so said that there were over 300 tramway and light railway undertakings in this country. The total capital invested in them was about £60,000,000, and the length open for traffic was over 2,200 miles. The number of cars in use was about 11,000, and the total number of passengers last year was 2,236,000,000, or over 6,000,000 per day. The gross receipts from all the undertakings last year amounted to over 10½ million sterling. From these figures it would be seen how important the industry was. There could be no doubt that in order properly to watch over an industry of this kind a central organisation such as this Association was necessary. It was also required for the purposes of removing unnecessary restrictions, and for carrying on negotiations for better terms for the common interests of the industry. It was recognised that Government departments preferred to deal with one body rather than with many. The Association had been in existence for some time, and it had received immense benefits from the recent efforts in its favour by its chairman, the Hon. Arthur Stanley. (Applause.) The Association was also of much value in view of the fact that in these days attacks were made on every form of property, and the Association was able to come to the help of those who were unjustly attacked.

Mr. E. GARCKE, in responding to the toast, said that though it was the case that there had been some controversy between separate sections of the tramway industry, that controversy was diminishing rapidly, and he looked forward to the day when they would all be able to meet and discuss points of particular interest without any feeling of rivalry or competition. The Light Railway Commission lately had lamented the falling off in light railway applications, but he thought that if light railways in sparsely populated districts were to be promoted, the conditions of promotion and the cost must be ameliorated. It was only by the most careful study of the conditions for rural lines that they could be made remunerative. To run too frequent a service had the effect of increasing the expenses out of proportion to the receipts, while to reduce the service below a certain point resulted in the recipts falling off in a larger ratio than the expenses. That reminded him of the steamer on the Mississippi which had such a large whistle that when it was blown there was not steam enough to run the steamer. (Laughter.) In reference to the magnitude of the tramway business, he pointed out that the profit on the increased capital was now about one-half per cent. less than it was 10 or 12 years ago. It was necessary that there should be an organisation to place the views of the tramway industry before Government departments, and he could think of no better organisation to perform that work than this Association, under the able chairmanship of Mr. Stanley. (Applause.) He hoped that they would be able to bring about a little more co-operative work with the other tramway associations, particularly the Municipal Association. The presidential address of Mr. McElroy at the recent Manchester meeting of the Municipal Tramways Association, had expressed the serious difficulties that all tramway promoters laboured under by reason of the veto of local authorities. Now that they were all in accord as to the necessity for some modification of that veto, there should be no difficulty in both bodies working together with a view to the adjustment of the matter. (Applause.) There were a large number of questions with regard to which all parties interested in tramways could take counsel and bring about improvement. The differences between the parties were but small. There was so much good in the worst of them, and and so much bad in the best of them, that they ought to be tolerant of each other, and endeavour to suppress the curious illusion which beset all mankind that they were mentally and morally superior to those who differed from them. (Applause.)

Sir ALEXANDER KENNEDY, in the absence of Mr. Atherley Jones, M.P., gave the toast of "Our Guests."

Sir RALPH LITTLER, K.C., C.B., in responding, referred to the work which had been done by the Middlesex County Council in connection with tramways and light railways. He pointed out that the County Council had constructed and owned many miles of light railways, and had leased them on terms satisfactory both to the County Council and to the lessee company. They had thereby got rid of that iniquity of the old iron story. At the end of the lease the County Council would pay to the company the fair working value, not old iron value, as a going concern of everything worth buying which belonged to the company's part of the undertaking. One thing which he did not welcome was centre poles, which took 8 ft. off the middle of the road, and wasted all the money spent for widening. He was happy to hear that the Board of Trade did not intend to allow any more of these centre poles. (Applause.)

Mr. STEPHEN SELLON proposed the health of the president, coupled with the name of the Hon. Arthur Stanley, M.P., the chairman of the Association. He said that the pioneers of the industry had in 1893 secured the appointment of Lord Cross's Committee, and had provided the money necessary to fight the strong organisation against electric traction, composed of the telephone company, the gas and water companies, and the railway companies. It was the verdict of Lord Cross's Committee which enabled electric traction to become what it was to-day. The pioneers had also been associated with Mr. Bryce's Committee in 1895, which settled the details which were embodied in the Light Railways Act of 1896, one of the most important pieces of legislation in the interests of electric traction in this country. In regard to the present work of the Association, they had before them now a most important report which had been presented to the authorities, dealing with the rating question. They had also been dealing with harrassing regulations which had been proposed from time to time by the Home Office, and one of their most important committees at present was that on brakes. That Committee had been sitting for the past eleven months, and it was hoped that within the next few weeks it would present a report to the Board of Trade which would be one of the most important treatises on braking which had ever been issued The Association was also now in the middle of a friendly arbitration with the Post Office on the vexed question which had been agitated for years, viz., fuses and heat coils.

The Hon. ARTHUR STANLEY, M.P., in responding, referred to the question of union with the Municipal Tramways Association. He still believed as strongly as he ever did that it would be a good thing if they could have one Association, or at all events that they should have combination where their interests were identical, so that they could make their interests heard. This Association so far had done all the wooing. They had met with one refusal, but no ardent lover was content with one refusal, and they would certainly continue their wooing in the hope even if the Municipal Association did not yield to their passionate entreaties, they might at all events see some use in a *mariage de convenance*, and that they might come together and live together in harmony, although their union must not be characterised with the absolute passion of love. (Laughter). There was a certain amount of similarity in tramways all over the world, and there was one thing which they wished to see, which was that the tramways industry should flourish not only in this country but abroad. He looked upon it as a curious and a happy coincidence that just as he was leaving for this dinner he had a telegram stating that an important concession for the building of tramways in Moscow had been given to a British company. (Cheers). This terminated the proceedings.

The annual meeting of the Association was held at the offices, 35, Parliament Street, London, S.W., on December 5. The report and statement of accounts for the year ending December 31, 1906, were submitted and approved. The Hon. Arthur Stanley presided, and gave a brief address on the work of the Association during the past year. It was announced that Mr. Cornwallis-West had resigned as a member of the council, and that Mr. C. H. Dade, of the British Electric Traction Company, had been elected by the council in his place. In accordance with the articles of the Association six members retired, and the following members were elected to fill the vacancies on the council: Messrs. Jas. W. Courtenay, J. B. Hamilton, R. J. Howley, E. Hatton, A. J. Salter, and H. M. Sayers.

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HALIFAX TRAMWAY ACCIDENT.

Report by Lieut.-Col. E. Druitt.

The following is the text of the report to the Board of Trade by Lieut.-Col. E. Druitt with reference to the recent accident at Halifax:

I have the honour to report, for the information of the Board of Trade, in compliance with the Order of October 15, the result of my inquiry into the circumstances of the accident which occurred on October 15 on the Halifax Corporation Tramways.

In this case, as tramcar No. 64 was ascending Pye Nest Road it got out of control of the driver, and, running back down the steep hill, left the rails at a curve in Bolton Brow, Sowerby Bridge, and overturned after coming in contact with a wall.

Two passengers and the conductor were killed, and two passengers died subsequently from injuries received, and 37 were injured. The motorman was practically unhurt.

The car, No. 64, was a four-wheeled car with a top deck—weight empty, 7½ tons. It has accommodation for 48 passengers, 22 inside and 26 outside. It is equipped with two 35 H.P. motors, geared direct to the axles, and fitted with three brakes, viz., (*a*) mechanical slipper brake on both rails, applied by worm gearing on a vertical spindle actuated by a hand wheel, (*b*) wheel brakes actuated by hand in the usual manner, and (*c*) rheostatic electric brake.

The gauge of the tramways is 3 ft. 6 in.

Description.

Pye Nest Road is on a steep gradient throughout.

Commencing at standard No. 28, just above Edward's Road, near which the car commenced to run back, the gradient is successively:

1 in 10	for a distance of	250 ft.	—partly on a compound curve with a least radius of 133 ft.
1 in 11·1	,, ,,	100 ft.	—straight.
1 in 13·8	,, ,,	100 ft.	,,
1 in 15·07	,, ,,	300 ft.	—of this 166 ft. are on a curve of 200 ft. radius.
1 in 14·59	,, ,,	1,000 ft.	—straight.
1 in 13·57	,, ,,	150 ft.	,,
1 in 12·71	,, ,,	240 ft.	,,
1 in 18·07	,, ,,	120 ft.	,,
1 in 43·76	,, ,,	151 ft.	,,
1 in 21·9	,, ,,	32 ft.	—on a curve of 160 ft. radius.

The car left the rails about 690 yards from where it commenced to run back. It was on a curve to the left of 160 ft. radius, and with a super-elevation of the outer rail of ⅞ in.

On leaving the rails the car ran across the road and footpath and came in contact with a projecting angle of a wall, which sheared the car top right off the underframe, and the latter was then overturned into the roadway. The car top was about thirty yards and the underframe fifty yards beyond the point of derailment.

The regulations for the conduct of the traffic in Pye Nest Road are as follows:

Speed 4 miles an hour on the downward journey.
Speed 6 miles an hour on the upward journey.

All cars must come to an absolute stop before entering Pye Nest Park, and motormen must here be sure that brakes, sand device, etc., are in good working order. When the rails are in bad condition any morning for first car down the motorman should have the rails sanded on curve both on the up and down lines before entering the Park. He should also bring his car to a stand before rounding other curves on this section, and sand both lines as above.

Other regulations for the Halifax Corporation Tramways lay down:

No. 75. In the event of a car starting to run backwards the first duty of the conductor is to drop sand at his end and keep the sand running until the car is stopped; at the same time apply slipper brake as quickly and as hard as possible. Do not touch the hand brake unless the motorman gives the signal (four bells) to do so.

No. 103. Where possible conductors should endeavour to collect their fares in such a manner that they will be free to remain on rear platform when on steep grades whether ascending or descending.

The Board of Trade regulations for the Halifax Corporation tramcars as regards brakes are:

The wheels shall be fitted with brake blocks which can be applied by a screw, or other means, and there shall be in addition an adequate electric brake and a slipper brake or other track brake approved by the Board of Trade for use on the tramways.

They shall also be fitted with a scotch or other device for preventing them from running backwards.

Conclusion.

The circumstances attending this unfortunate accident were as follows:

Driver T. H. Simpson left the depot with car No. 64 at 4-45 a.m. on October 15, after satisfying himself that it was in proper working order, for which a quarter of an hour is allowed. He took the car down the steep gradient in Pye Nest Road quite safely and went out to the terminus of the route at Triangle. On the return journey the last stopping place before the accident was in Bolton Brow at the bottom of Pye Nest Road, and the car left this with a full load of passengers. The actual number is not known, but several were standing up inside the car in addition to the 22 for whom there is seating accommodation, and there were about 20 outside. It was a damp morning so passengers naturally tried to get under cover. The car went up the road as usual, and round the first curve and also partly round the curve opposite Edward's Road, when the current went off, owing to the circuit breaker for this section of the lines coming out at the central generating station. Just previous to this the driver states he had to use sand as the wheels began to slip.

He states that the action he took when the current failed was as follows:

"I at once pushed the controller round to the 'off' position and put on the wheel brake. This did not hold the car, so I took a second pull at the brake and then the wheels skidded. I then released the wheel brake, and applied the electric brake and the slipper brake. I used the controller as though the car had not got a run back device on; I put the controller handle back to the fifth brake notch and put the reversing handle in the reverse position."

"The current came on again for a brief interval after the car had commenced to run back and I swung the handles round to put on current, but before I could get current, the trolley arm left the overhead wire and was smashed. I then tried the electric brake again, but it had no effect. The wheels of the car were revolving the whole time I did not try the wheel brake again, as I thought it would cause the wheels to skid."

"I did not signal the conductor to put the slipper brake on at his end. I cannot say where he was when the car began to go back. Nothing checked the car and it gained speed the whole time, and on reaching Bolton Brow it went over."

A witness named E. Priestley, whose duty it is to clean the rails on the Pye Nest route before the first car goes down it in the morning, stated that he was engaged on this work when car No. 64 went down the hill in the early morning, and that afterwards he went to the end of Edward's Road to catch the car on its return journey. He states that the car stopped near pole No. 29, and was just beginning to run back when he got on the rear end of the car and was starting to put on the slipper brake at that end when the conductor rushed out of the car, and pushed him away, and a passenger coming down the stairs collided with him, and he fell off into the road before he could put the slipper brake on or drop sand. He also stated that the arc lamps on the bracket poles along this road were not lighted, so that when the current failed and the lights in the car went out at 5-45 a.m., the car and road would be in total darkness.

It may be well to mention here that owing to the very steep gradients on the Halifax system, the danger of cars running back has been recognised by the tramway authorities, and a special electrical device has been introduced by the Rolling Stock Superintendent into some of the controllers of the cars, which acts very successfully when brought into use.

On car No. 64 the controllers are of the Westinghouse No. 90 type. At one end the controller has the special run-back chain attached, and is known as the "B" style of controller; at the other end the controller was unaltered. To apply the electric brake in case of a run back when the current has left the overhead wire on the "B" style of controller, all that has to be done is to swing the power handle round to the last brake notch, and leave the reversing lever in the forward position.

In the unaltered controller the reversing lever has to be pulled backwards to the reverse position, in addition to placing the power handle to the last brake notch.

To distinguish the "B" style of controller two letters B are painted in white characters about one inch in length on the iron rail of the car in front of the controllers so fitted.

I understand the reason why the device has not yet been fitted to the controllers at both ends of No. 64 car is because this car is selected with others to run on the Pye Nest route only, as it has powerful motors, and as there is a very steep rising gradient only on the inward journey, and the cars are always run in one direction, there is no need for the device except on the leading end coming up the gradient.

It takes time to get the cars fitted, as this can only be done when they are brought into the depôt for thorough overhauling, so the cars which run on routes with steep gradients in both directions have been first provided with the device at both ends. This device has been adopted after trials of others of a somewhat similar nature, but which were not entirely satisfactory.

Motorman Simpson is an experienced driver. He was regarded as a first-class man, and worked on the routes with the steepest gradients. He has been a motorman for eight years, and has constantly driven cars with different types of controllers over the Pye Nest route since it was opened for traffic five years ago. He has never had any accident previously. From the returns it appears that he has made 2,280 ourneys over this route in the five years, of which 340 were

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made with the conductor W. Robinson, who was with him on this occasion. But he admits he failed to notice on this occasion the style of controller the car was fitted with at either end, and that he did not use the special device for preventing cars running away backwards, which was fitted to the controller at the leading end of the car, when ascending the gradients, but turned his controller handle and reversing lever to the positions they should have occupied if the controller had been of the unaltered type. If he took this action, it follows that there was no electrical braking effect on the car whatever.

Although no doubt it is very desirable to have the controllers at both ends of the car similar in all respects, yet with his thorough knowledge of the types of controllers in use on the cars, he must, I think, be regarded as having been careless in this respect, as not only were there the letters B on the rail in front of the controller to remind him, but also he should have tested his electric brake on the long falling gradient coming back from Triangle on the return journey, as it was the first time that morning he had driven the car for any distance from that end of it. Had he done so he would have found out the type of controller he was using, as the reversing lever has to be pulled back to the reverse position for the "B" type, and not for the ordinary type of No. 90 controller, to apply the electric brake.

It is difficult to draw any conclusions from the position of the barrels of the controller and reversing gear as found by the tramway authorities after the accident. Both the controller handle and reversing lever were picked up undamaged in the road, but the position of the spindles were such that the pointer of the controller handle was at the fifth brake notch, and the reversing lever in the "reverse" position. But it is impossible for the reversing lever to be removed from its spindle when in the reverse position unless it is broken, so it is evident that the lever had either been in the neutral position when the car overturned, and so could fall off, and the barrels of the controller had been shaken into the positions in which they were found, or else the lever had been removed by someone after the accident, and the spindle moved back to the reverse position by the lever without its being actually fitted on in the usual manner.

On examining the car after the accident it was also found that the positive armature terminal for No. 1 motor was disconnected from the cable. This probably occurred either just as the current failed, or from the shock of the car overturning. Judging by the appearance of the terminal, it occurred when the current failed, as the end of the cable had evidently been very hot and the solder had melted. This broken connection could cause a short circuit resulting in the overload switch at the power-station coming out and cutting off the current from that section of the system. The effect of this disconnection would be to limit the electric braking effect to No. 2 pair of wheels only, and it is doubtful if this would have checked the car very much.

There was a slight flat on each of the second pair of wheels, from which it would appear that they had been subjected to some retarding influence.

The wheel brakes and slipper brakes were in working order. Car No. 64 had been in the shops for repair on the day previous to the accident; and the controllers were then examined and cleaned, new slipper brake blocks fitted, etc.

The last time that the controller had been taken off the car and thoroughly overhauled by a fitter was on May 4 last, and it was replaced on May 6. The connection which became loose could not be examined except when the controller is overhauled and off the car, as it is behind the terminal board and out of sight.

It would appear desirable that the connections at the back of the controller should be examined rather more frequently than happened in this case.

One witness, who was on the top of the car when the current failed, states that as soon as this happened the car stopped and began to go backwards and gather speed, and that it gathered speed the whole way. He came down the steps, and reached the driver's platform when the car had just got round the first curve, about 220 yards from where the current failed, and the motorman was then still applying the slipper brake by turning the wheel, which shows that he did not apply it fully as soon as the emergency arose.

This form of brake is a good one, but it takes a certain amount of time to apply fully, and if a car has once acquired a high speed it will not stop the car on a steep gradient like the one in Pye Nest Road.

The car should not have gained speed so rapidly if the slipper brake had been applied as soon as possible after the current failed, and evidently the motorman could not have done so.

Unfortunately, too, the conductor was collecting fares either inside or outside the car (the reports vary), so he could not apply sand at once and help to put on the slipper brake from his end of the car, and the car had acquired considerable speed before he did so.

As electric brakes can be rendered inoperative by the locking of the car wheels, or by a break in the electric connections, or by the breaking of an axle even if the motorman on a sudden emergency does place the controller handle and reversing lever in the right position (and some accidents have occurred from a mistake being made in this respect), I consider that on steep gradients more reliance can be placed on a slipper brake, which can be applied and get its effect independently of the revolution of the car wheels; but it is most desirable that the method of application shall allow of the brake going on instantaneously on an emergency arising, as once a car is out of control it is almost impossible to stop it on a steep gradient, but if the brake can be applied instantaneously the car ought never to get out of control.

Instantaneous application of slipper brakes has been carried out both by a corporation and a tramway company (on systems with steep gradients, and where the climatic and local conditions cause very greasy rails) by means of compressed air, and the results have been very successful. Another corporation is experimenting with a device worked by a friction clutch on the axle and a chain attachment to the brake lever, by which means the slipper brake can be applied practically instantaneously, and I have seen trials by a tramway company in which the slipper brake ordinarily in use can be instantaneously applied by means of a lever releasing a powerful spiral spring, the brakes being held off by the spring being brought into tension by turning a hand wheel.

This is not the place in which to discuss the merits of any particular form of brake, and I understand two committees are now engaged on this subject. I think, however, more use would have been made of slipper brakes actuated by air pressure, which have many advantages, but for the idea that they are costly and difficult to maintain. This is not the experience of the corporation above referred to, and improved forms of compressors are now available, or storage reservoirs on the cars can be charged from a compressor plant at the depot.

I recommend the Halifax Corporation to equip the cars for service on the very steep gradients with a form of slipper brake that can be fully applied instantaneously. I also consider that while cars are on very steep gradients, the conductor should be on the rear platform ready at any moment to assist the motorman by applying the slipper brake, and dropping sand as well in case of a car running back.

Also, if it is impossible to have only one form of motor equipment, that motormen should be employed as far as possible on cars with the same type of controller, as mistakes can so easily be made regarding the position of the controller handle and of the reversing lever, and that motormen should be examined on their cars at uncertain intervals, as to the action to be taken on any sudden emergency arising, especially on steep gradients. Also that the curves on steep gradients should be thoroughly cleaned and sanded by men specially appointed for the purpose before the first car goes over the track in the morning, and that the arc lamps in Pye Nest Road should always be lighted during the dark hours of the day that cars are run over this route.

Oxford and the Dolter System.—As is generally known, Oxford Town Council have for some time contemplated the use by the tramway company of the Dolter surface-contact system when the lines are electrified. By the terms of an agreement between the Council and the Dolter Company an inspection was to be made by the Corporation of some tramway run on the Dolter system for six months, and they were to state definitely before January 1, 1908, whether they considered it satisfactory for Oxford. On the invitation of the Dolter Company the Corporation visited Hastings on December 16, and they were accompanied by Mr. Stephen Sellon, their expert adviser. The Dolter system, as installed along the Hastings sea-front, was carefully examined. On December 19 the General Purposes Committee of the Corporation held a meeting, and, having considered a report by Mr. Sellon, they passed a resolution declaring that in their opinion the Dolter system has not been working satisfactorily in any town in Great Britain for six months. The report of the Committee was adopted by the Town Council on December 30.

London Southern Tramways Company. Mr. J. Barber Glenn, secretary and liquidator of the London Southern Tramways Company, has issued a circular to the shareholders in which he says that the various matters connected with the sale of the company's undertaking to the London County Council have now been completely disposed of and all the creditors paid, and he is in a position to make a return to the shareholders of £1 2s. 7d. per share. He proceeds to point out that the tramways had been run at a loss for six or seven years, and it would not have been possible to continue working them so long only by the financial support of the chairman and himself. It was desirable to keep the tramways running, because it was believed that they would be purchased by the London County Council. Mr. Glenn then narrates the unsuccessful attempts made by the company in 1905 and 1906 to get a bill passed to authorise the company to electrify the lines and to extend the date of purchase. These attempts, however, brought the County Council to purchase the system, and it was arranged that it should be bought under Section 44 of the Tramways Act, instead of waiting till 1910, when it could be bought under Section 43. The undertaking was, however, sold at the "then value" as defined by Section 43, and the price fixed by arbitration was £60,000. Out of the money the debenture debt, creditors for loans, and tradesmen's accounts were paid, and the balance is now distributed to the shareholders. The company, it may be noted, was incorporated by Act of Parliament in 1882, and the share capital consisted of 9,000 shares of £10 each.

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FINANCIAL COMMENT.

In spite of the rise in prices which ushered in the New Year, the future outlook for the stock markets generally is very uncertain. The statistics of our foreign trade as well as the railway receipts from traffic and the London Clearing House returns, show clear indications that the revival in trade, so conspicuous during the last two years, is waning. Competition has been more than usually keen, and the profits accrued have not been so great as in former periods of trade expansion. At the same time there is still a want of credit in every market for money throughout the world, as shown in the continued competition for gold everywhere, and there is hardly a government or corporate undertaking of importance that is not awaiting anxiously a convenient moment for issuing a loan.

In these circumstances the general level of prices for all classes of shares must remain low, and the shares of tramway and electrical undertakings cannot be expected to rise very much. Our chief object in devoting a page of this journal to financial comment will be to point out examples and occasions of conservative finance which make the reasons for any further decline in price of as small effect as the circumstances permit.

THE CARTHAGENA AND HERRERIAS STEAM TRAMWAY COMPANY, LIMITED.

This tramway is in the remarkable position of carrying more goods than passengers. For the year 1906 the latter amounted to 628,279 tons, an increase of 158,782 on the previous year, while the number of passengers only amounted to 337,538, an increase of 31,488. The major portion of the goods traffic consists of iron ore, and the depression of the trade in that commodity of late has resulted in a fall of the price of the company's shares to 6½-7½, the shares being of the nominal value of £10. They were sold as high as 11 during last summer, and are now quoted 7-8. At this price they cannot be thought dear, however unfavourable a view be taken of the immediate prospects of the iron trade. The capital of the company is £150,000 in shares of £10 each, in addition to which there are 5 per cent. registered debentures issued in 1905 to pay off previous debentures, the interest and sinking fund charges for which amount to £6,000 annually. The gross receipts for 1906 amounted to £53,609, and the expenses to £29,427. The nett revenue was therefore £24,182, and, deducting the £6,000 now required to meet the debenture charges, there remains £18,182 available for dividend upon the shares, *i.e.*, 12 per cent. The aggregate receipts for 1907 up to the end of November still show a slight increase on those of 1906, though there was a falling off during that month, for the reason already given. The average rate of exchange with Spain during the past year also has been on the whole much the same as that which held in the previous year. The company is therefore still earning 12 per cent. on its share capital, and if it could be relied upon to distribute the whole of its earnings, the shareholder might expect a dividend at this rate. That the price of the shares in spite of this has fallen to 7 shows very clearly that the policy will be directed towards building up larger reserves.

At present a renewal fund of £7,000 represents all that has been done to this end, and in view of the depressed condition of the trade in iron and other ores the position of the company would certainly be bettered by the accumulation of more reserved strength.

The length of line, too, is but about nine miles, so that the capitalization is heavy in spite of the present high rate of earning capacity. The competition of a rival tramway might even be feared, if local enterprise were more alert. The establishment of a reserve fund separately invested would no doubt act as a further discouragement to rival construction, so that on these grounds as well a handsome addition to the liquid resources of the company is highly desirable. It is to be noted that even so short a time ago as 1905 the price of the shares was 2, and the dividend paid no more than 3½ per cent.

POTTERIES ELECTRIC TRACTION COMPANY, LIMITED.

From the investor's point of view, this company's position is not encouraging; the prices quoted for its shares are both low and wide: for the £1 ordinary shares, $\frac{5}{16}$ to $\frac{9}{16}$; for the 5 per cent. cumulative preference shares also of £1, ½ to ¾. Yet earlier in the year the full dividend of 5 per cent. was paid on the latter shares, and 4 per cent. was paid on the ordinary. The business of the company is improving, not rapidly, but with marked progression, and whatever may be thought of the dividends paid in former years there can be no doubt that if attention be confined to the accounts for 1906 the last dividend was fully earned. The expenditure on maintenance and repairs was £16,250 or ·205d. per passenger carried, and further sums amounting to £5,000 in all were appropriated out of profits to renewal reserve funds. The amounts suggest that provision for depreciation of property and renewals of plant had been neglected in the past. However this may be, it is a criticism not reflected in the market movement of the shares, since in past years when the dividend was the same the prices were very much better. Thus in 1905 both ordinary and preference shares stood near to their par value, and even during 1906 the quotation did not decline to less than ¾ of the par value in the case of the preference, and ⅜ of the par value in the case of the ordinary shares. Probably the present smallness of the lower limit of the prices quoted may be ascribed to the appreciation of the fact that only 10 years now remain of the period during which the local authorities have agreed not to exercise their powers of acquisition of part of the tramway, under the Act of 1870. In that case the disparity of the prices quoted for the ordinary and preference share respectively still leaves something to be explained; since the latter, though carrying preferential and cumulative rights in respect of dividend, rank *pari passu* with the ordinary shares in a division of capital.

THE RANGOON TRAMWAY.

This undertaking has invited the subscription of 10,000 shares of £5 each, carrying cumulative preferential rights to 6 per cent. per annum in dividends. In times like the present, when no applications are made to the public for money by those who are able to avoid it, the terms offered may be examined by investors with a much more likely prospect, than in ordinary times, of finding something cheap and good. In the case of Rangoon, the town is undoubtedly increasing; in fact, no other port east of Suez has grown more rapidly in recent years. It is the principal town of the province of the same name, and His Excellency the Viceroy, when opening the new works of the port on November 22 last, took occasion to observe: . . . "Its potentialities are perhaps greater than those of any other province. It is a land of immense natural resources, with its teak forests, its enormous area under rice, and its minerals, the scientific development of which is only now beginning."

It sounds rather like an excerpt from a share-touting circular, but even Viceroys, with unlimited secretarial assistance, must find it hard to express themselves originally, when there are so many occasions on which something pleasing and sanguine is expected in the circumstances. Rangoon, however, has a future, and in the estimation of its inhabitants a near future. This perhaps will best be demonstrated to persons contemplating an investment in the 6 per cent. Preference Shares offered, by the fact that 25,000 £1 Ordinary Shares have been subscribed locally at £2 per share. A full service is at present maintained on some 20 miles of tramway, but the demand for energy is already beyond the capacity of the plant (1,900 KW.).

The growth of the consumption of power both for lighting and other purposes now requires an additional 3,400 KW. to provide which, with the necessary distribution system, involves the expenditure of £100,000. Half of this has been obtained by the issue of ordinary shares locally, at a premium, as related above, and the other half is expected from Great Britain by the issue of these Preference Shares. The latter were underwritten for a commission of 2½ per cent. and ½ per cent., but it is not unlikely, in the present hard times, that they may come upon the market at even greater discount. Nevertheless, they seem to offer a distinctly good investment at par.

COUNTY OF DURHAM ELECTRICAL POWER DISTRIBUTION COMPANY, LIMITED.

Another example is afforded by the £250,000 5 per cent. first mortgage debenture stock of the County of Durham Electrical Power Distribution Company, Limited. The company is under contract to take its energy in bulk from the Newcastle-upon-Tyne Electric Supply Company; and the latter having purchased the stock at 95, passes it on to the public strengthened with an unconditioned guarantee of interest. The County of Durham Electrical Power Distribution Company own nearly all the shares of the County of Durham Electric Power Supply Company, and between them these two companies have expended close upon half a million of money in transmission cables, transforming station, and distributing plant, together with the cost of the necessary Acts and Provisional Orders. The total profits for 1906 were over £19,000, and those of 1908 are expected to be double this amount. It is a pity if these complexities of arrangement between similar and allied companies be unavoidable in the development of the business. When companies buy each other's shares, and find it necessary to guarantee each other's debentures, it is difficult to compare the security offered with that offered by existing stocks; and what confuses the prudent investor and hinders his judgment cannot benefit borrowers in the long run. However, the Newcastle Company has paid 8 per cent. dividend for many years past, and its guarantee is an important addition to value.

GERMAN PROFITS.

While the electrical industries of this country have been languishing on lean business in spite of record statistics for general trade, the German manufacturers in the same line of business flourish exceedingly. The Allgemeine Elektricitäts Gesellschaft on a capital of £5,000,000, not only pays 12 per cent. in dividends for the year ending with June last, but makes additions to its reserves, payments to managers and staff, etc., amounting in all to a sum which would suffice for a further bonus of nearly 3 per cent. For the previous year 11 per cent was paid, and the present achievement is no sudden burst of prosperity. The company is strong in its finances, having accumulated reserves and other credit balances to the aggregate amount of £2 340,000, a larger sum than the whole of the borrowed capital.

The business, moreover, would appear to be as sound as it is profitable. The dangerous expedient of promoting or assisting in the promotion

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of other companies for the purpose of obtaining orders from them, has apparently not been adopted. How many managers of English undertakings must have regretted that they ever became acquainted with such a method of stimulating business in difficult circumstances.

This company completed during the year the equipment of some 65 different works to the aggregate amount of 95,000 H.P., and has nearly as much again under construction. Included in the latter is the installation for the Victoria Falls Power Company, and it seems a pity that with so many kindred establishments at home hungering for orders the investments of our countrymen should swell the profits of an alien concern.

Declining from the high profits of the Allgemeine Company the Siemens and Halske Company and the Berliner Telephone Manufacturing Company pay respectively, 11 per cent. and 10 per cent., all of which is very satisfactory from the German point of view. At the same time there has reappeared during the last month, from several sources, the unending plaint which, however, is not confined to electrical manufacturers, that British firms do not trouble to push their business abroad, do not send out travellers who speak native tongues, do not send catalogues other than in English, neglect to consider the special wants of likely customers, and by despising small orders lose large. The two things may not be wholly unconnected. There have been erected some considerable electrical works in the prosperous states of South America of late years, and much of it has gone into German hands.

FINANCIAL REPORTS AND COMPANY MEETINGS.

Launceston Tramway Company.—The prospectus has been issued in Australia and Tasmania of the Launceston Electric Tramway Company. The capital is £100,000 in £1 shares, and the first issue is of 50,000 shares, of which 8,000 credited as fully paid-up go to the vendor. Arrangements have been made with Messrs. Noyes Brothers for the construction and equipment of the lines. The secretary is Mr. W. J. T. Campton, of Messrs. Sprigg and Campton, Melbourne.

Blackpool, St. Anne's, and Lytham Tramways Company.—The annual report of the directors states that the invariably wet weather experienced during most of the year seriously affected receipts. The net profit is, however, only £244 less than last year. The total traffic receipts were £27,490, and the balance from revenue account is £6,500; debentures absorb £7,500, £1,500 is put to sinking fund, and the debit balance from the year previous (£10,036) has been increased to £13,053.

Delhi Electric Tramways and Lighting Company.—At the first ordinary meeting of this company on December 12, in London, Colonel Sir Buchanan Scott stated that delays had occurred in carrying out the construction work by the contractors (Messrs. Bruce Peebles and Company, Limited), owing to an outbreak of plague and a deficiency of labour. The work to be carried out included 10 miles of line, three-quarters of which would be double track. The cars would be worked by the overhead wire system. It was expected that the works would be completed and handed over to the company in January. The lighting works were yielding a small profit.

Manx Electric Railway Company.—The directors' report, which was submitted to a meeting of this company in London on December 10, recommended a dividend of 1 per cent. on the ordinary shares. The chairman (Mr. A. G. Boscawen) said that, while the visitors to the island had increased by a little over one per cent., the travellers on the line had increased by over two per cent., thereby showing the increasing popularity of the railway. They were doing all they could to popularise by motor, char-a-banc, and other facilities, both the Laxey Glen and Sulby Gardens, and their efforts had been fairly successful. As to the electrification of the Douglas tramways and the electric lighting of the town, he understood that a portion of the Corporation were in favour of something being done in that direction. If so the offer of this company to undertake the work was still open. The report was adopted.

Provincial Tramways Company.—At the annual meeting of this company in London on November 29, Mr. Andrew Beattie, who presided, said that the company had never had a better year than the one under review. The receipts were £38,046—an increase over those for the previous year of £7,055, or nearly 22 per cent. During the last few years they had been making great progress, and the figures for the current year since October 1 showed a still further increase in revenue. Owing to the conditions prevailing in the money market, the directors had found it impossible to make a successful issue of the 4½ per cent. debentures, which were authorised last year; and, in lieu of this, they proposed to issue £175,000 of 5 per cent. debentures, which would be underwritten.—This company have issued for subscription at par £175,000 of 5 per cent. first debenture stock in £10 shares. The issue is principally for the purpose of discharging capital liabilities in connection with tramway undertakings of which the company hold all the shares.

UNDERGROUND ELECTRIC RAILWAYS COMPANY.

The fifth annual report of the directors of the Underground Electric Railways Company of London, Limited, states that with the exception of a short length of line all the construction work undertaken by the company has been completed. The Lots Road generating station is now supplying electric power to the District, Baker Street and Waterloo, Great Northern, Piccadilly, and Brompton, and Charing Cross, Euston, and Hampstead Railways, as well as to a section of the London United Tramways. The average output is now about 100,000,000 units per annum, and this is sold at a price which while reasonable to the railway companies yields a satisfactory profit on the expenditure on the power-house. The report then refers to the increasing traffic on the four railways and on the London United Tramways, and to the engagement of Mr. A. H. Stanley as general manager of the Underground company and of the four railways. Subsequently it states that the very unsettled state of the money markets of the world has seriously hampered the development and operations of the company. Stocks dependent on London traffic have, owing to severe competition and excessive reduction in fares, fallen lower than many securities of intrinsically less value. The competitors include the London County Council, on whose tramways passengers are carried at fares which, it is believed, are in many cases unremunerative, and the motor omnibus companies who can probably not operate profitably on the basis of their existing fares The recently formed Traffic Conference is discussing the best means by which injurious competition can be as far as possible avoided. Reference is also made to the recent arrangement for paying the December coupons of the £7,000,000 of profit-sharing notes of the company, and the forthcoming plan for dealing with the notes. The balance sheet is as follows:

Dr.		£	s.	d.
To Share Capital authorised—				
500,000 Ordinary Shares of £10 each	£5,000,000			
„ Share Capital issued—				
500,000 Ordinary Shares of £10 each	£5,000,000			
Less calls unpaid	165,875			
		4,834,125	0	0
„ 5 per cent. Profit Sharing Secured Notes		7,000,000	0	0
(These Notes are secured by Stocks and Shares deposited under terms of a trust deed with the London and Westminster Bank, Ltd., dated 29th May, 1903.)				
„ 4½ per cent. Power-House Debentures issued (£850,000 authorised)...		775,000	0	0
„ 4½ per cent. Power-House Second Debentures authorised	£600,000			
„ 4½ per cent. Power-House Second Debentures issued	£300,000			
„ Loans secured on stocks, shares, £300,000 Power-House Second Debentures and Parliamentary deposits		1,234,293	18	11
„ Sundry creditors, credit balances, and retentions, including unpaid interest and interest accrued on Profit-Sharing Secured Notes and Power-House Debentures		350,905	16	2
„ Depreciation reserve (Chelsea power-house)		41,002	3	7
„ Net amount realised to date on sale of stocks and shares, and cash, received on account of construction contracts... ...		3,723,291	9	11
		£17,958,618	8	7

NOTE.—There are contingent liabilities in respect of construction contracts etc.

Cr.	£	s.	d.
By cost to date of construction of power-house and transmission line, and of freehold land and buildings at Lots Road, Chelsea	1,306,356	7	2
„ Investments in stocks and shares at cost	2,805,890	3	9
(The market value of these stocks and shares, which are for the most part investments in the London United Tramways, Ltd., and the Metropolitan District Railway Company, shows a considerable depreciation.)			
„ Parliamentary deposits (£209,894 1s. 6d. Consols) at cost... ...	198,933	7	2
(Value at June 30, 1907, £177,360 9s. 10d.)			
„ Cost of railway construction and expenditure chargeable to various construction contracts, including general expenses and all interest paid and accrued, less income from investments and from Chelsea power-house	13,065,083	1	10
(Stocks and shares have been received on account of this expenditure in accordance with construction contracts, the value of which cannot at present be assessed.)			
„ Discount on issue of 5 per cent. Profit-Sharing Secured Notes (issued at 96)	280,000	0	0
„ Sundry debtors, debit balances, stores, etc....	179,400	1	1
„ Cash at bankers, at short call and in hand	122,955	7	7
	£17,958,618	8	7

The fifth ordinary general meeting of the Company was held on December 23. Sir Edgar Speyer, the chairman, in moving the adoption of the report and accounts (which had already been published) for the year ended June 30 last, said that the directors hoped early in the coming year to submit a scheme dealing with the company's finances. The board would then explain their proposals in detail, and he would reserve his remarks till then. The motion was adopted.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track). Mls.	Chs.	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Sinking Fund and Loans Repaid.	Depreciation, Renewal, and Reserve Funds.	Income. Traffic.	Other.	Total.
Aberdeen ...	May 31, 1907	Dec., 1899	E.	27	60	350,000	317,140	32,860	345,025	12,433	299,970	17,169	40,155	65,853	834	66,687
Ayr ...	May 15, 1907	Sept., 1901	,,	9	52	105,000	70,000	35,000	79,934	8,283	62,752	4,820	14,954	14,672	541	15,213
Birmingham ...	Mar. 31, 1907	Jan., 1904	,,	...		1,079,687	743,037	336,650	850,916	...	732,016	11,021	25,932	132,662	3,762	136,424
Blackburn ...	Mar. 25, 1907	Mar., 1899	,,	23	64	400,337	328,087	72,250	330,563	13,469	236,042	81,647	...	52,811	2,141	54,952
Blackpool ...	Mar. 31, 1907	June, 1899	,,	17 * 3	30 69	424,490	281,390	143,100	281,390	16,195	281,390	54,624	13,236	50,554	952	51,506
Bolton ...	Mar. 31, 1907	Dec., 1899	,,	42	42	632,760	528,027	104,733	471,760	11,033	377,482	71,801	48,622	110,935	359	111,294
Bradford ...	Mar. 31, 1907	July, 1898	,,	87 * 9	67 6	1,192,626	902,878	289,748	903,368	9,321	756,992	200,046	38,024	227,495	4,612	232,107
Brighton ...	Mar. 31, 1907	Nov., 1901	,,	17	15	279,070	274,070	5,000	274,905	15,994	257,186	20,885	3,165	48,898	1,755	50,653
Burnley ...	Mar. 31, 1907	Dec., 1901	,,	14 * 5	20 32	278,892	252,896	25,996	185,325	13,005	175,331	23,012	20,793	62,076	728	62,804
Burton-on-Trent	Mar. 31, 1907	Aug., 1903	,,	9	70	100,073	88,336	11,737	92,971	9,415	83,746	...	...	15,102	430	15,532
Bury ...	Mar. 31, 1907	June, 1903	,,	17 * 9	50 21	407,800	225,525	182,275	242,466	13,757	223,500	8,246	5,904	50,518	131	50,649
Chester ...	Mar. 25, 1907	April, 1903	,,	6	35	92,991	73,991	19,000	77,662	12,064	70,221	5,141	332	10,274	329	10,603
Chesterfield ...	Mar. 31, 1907	Dec., 1904	,,	5	68	95,000	68,528	26,472	68,529	11,714	65,000	2,557	...	10,989	503	11,492
Colchester ...	Mar. 31, 1907	July, 1904	,,	7	75	70,748	68,755	1,993	68,847	8,673	65,858	4,214	...	10,787	580	11,367
Croydon ...	Mar. 31, 1907	June, 1906	,,	19	44	336,611	254,010	82,601	270,043	13,813	224,234	35,276	...	61,091	975	62,066
Darlington ...	Mar. 31, 1907	June, 1904	,,	8	71	107,500	75,165	32,335	76,293	8,584	69,425	5,540	...	10,820	323	11,143
Darwen ...	Mar. 31, 1907	Oct., 1900	,,	7	13	93,400	85,400	8,000	85,436	11,928	73,879	13,658	1,150	13,327	681	14,008
Derby ...	Mar. 31, 1907	July, 1904	,,	E. 15 H.	1	...	...	...	175,247	...	159,722	15,525	...	E 37,558 H 4,184	871 147	38,429 4,331
Doncaster ...	Mar. 31, 1907	June, 1902	,,	10	42	92,500	84,200	8,300	84,735	8,051	79,300	5,727	...	12,030	337	12,267
Douglas (I.O.M.)	Mar. 31, 1907		H. C.	3 2	40 60	54,020	54,020	...	55,514	8,882	49,166	4,889	3,000	20,220	1,314	21,534
Dundee ...	May 15, 1907	July, 1900	E.	24	41	...	...	...	312,886	12,746	258,824	47,613	26,780	56,921	751	57,672
East Ham ...	Mar. 31, 1907	June, 1901	,,	12	61	160,442	160,133	309	164,064	12,855	146,323	20,775	3,442	46,435	653	47,088
Gloucester ...	Mar. 31, 1907	April, 1904	,,	12 * 2	41 39	151,000	126,000	25,000	127,326	10,186	123,333	3,993	...	14,192	841	15,033
Halifax ...	Mar. 31, 1907	June, 1898	,,	52	26	663,751	393,764	269,987	393,280	7,516	333,287	48,149	8,544	75,986	1,341	77,327
Ilford ...	Mar. 31, 1907	Mar., 1903	,,	11	28	142,603	142,396	207	142,396	12,546	129,549	13,054	6,532	24,478	912	25,390
Ipswich ...	Mar. 31, 1907	Nov., 1903	,,	14	70	116,471	110,000	6,471	114,334	7,687	106,098	4,674	...	21,262	780	22,042
Keighley ...	June 30, 1907	Oct., 1904	,,	6	9	50,934	46,004	4,930	46,004	7,526	39,891	6,827	1,641	8,019	222	8,241
Kilmarnock ...	May 15, 1907	Dec., 1904	,,	5	42	65,000	54,615	10,385	54,078	9,788	54,615	151	...	8,246	357	8,603
Kirkcaldy ...	May 15, 1907	Feb., 1903	,,	7	62	200,000	88,693	111,307	89,404	11,499	83,750	4,943	1,267	13,230	473	13,703
Lancaster ...	Mar. 25, 1907	Jan., 1903	,,	4	65	60,000	51,550	8,450	41,339	8,590	46,250	5,651	...	5,360	119	5,479
Leith ...	May 15, 1907	Aug., 1905	,,	11	76	225,000	171,345	53,655	179,796	15,046	179,062	6,873	...	26,380	643	27,033
Lincoln ...	Mar. 31, 1907	Nov., 1905	2	2	77	98,519	43,072	55,447	39,231	13,243	48,061	2,849	...	5,741	104	5,845
Liverpool ...	Dec. 31, 1906	Nov., 1898	E.	104	0	2,442,600	2,044,775	397,825	1,901,937	18,288	1,604,435	503,941	238,354	563,777	7,439	571,216
Lowestoft ...	Sep. 30, 1907	July, 1903	,,	5	79	129,230	79,231	49,999	79,231	13,233	75,135	5,076	...	10,937	349	11,286
Maidstone ...	Mar. 31, 1907	July, 1904	,,	2	23	25,000	25,000	...	26,255	11,477	25,005	1,250	2,000	5,650	241	5,891
Manchester ...	Mar. 31, 1907	June, 1901	,,	111 *43 †14	6 57 54	1,875,015	1,558,669	316,346	1,725,845	15,538	1,436,184	144,197	320,028	712,976	6,697	719,673
Nelson ...	Mar. 31, 1907	Feb., 1903	,,	3	69	38,000	35,662	2,338	35,662	9,233	33,291	2,371	...	7,264	55	7,319
Newport (Mon.)	Mar. 31, 1907	April, 1903	,,	14	40	264,500	189,819	74,681	199,424	13,753	180,461	18,003	1,046	32,547	652	33,199
Nottingham ...	Mar. 31, 1907	Jan., 1901	,,	35	58	730,300	581,734	148,566	581,734	16,284	473,128	116,340	53,668	137,998	1,995	139,993
Oldham ...	Mar. 25, 1907	May, 1902	,,	27 * 8	20 31	507,769	439,547	68,222	440,422	16,162	380,354	94,643	6,119	92,763	1,315	94,078
Perth ...	May 15, 1907	Nov., 1905	,,	8	40	70,000	73,400	...	74,879	8,809	70,450	3,710	...	7,985	411	8,396
Plymouth ...	Mar. 31, 1907	Sept., 1899	,,	15	0	182,856	174,906	7,950	215,986	14,399	132,872	45,355	23,126	31,256	10	31,266
Rochdale ...	Mar. 31, 1907	May, 1902	,,	24 * 5	45 26	354,491	345,000	9,491	343,246	13,974	345,000	16,231	...	53,830	308	54,138
Rotherham ...	Mar. 31, 1907	Jan., 1903	,,	10	0	228,550	112,500	116,050	123,914	12,391	104,040	8,517	9,181	26,917	819	27,736
Salford ...	Mar. 31, 1907	Oct., 1901	,,	36 *38	40 20	1,192,246	669,583	522,663	574,853	15,749	626,609	125,701	46,146	232,551	...	232,551
Southampton ...	Mar. 31, 1907	Jan., 1900	,,	16	22	202,539	172,397	30,142	200,183	12,300	164,242	35,659	690	49,636	1,368	51,004
Southport ...	Mar. 31, 1907	July, 1900	,,	10 * 8	61 78	292,000	196,500	95,500	195,412	9,930	157,230	39,270	6,773	18,176	307	18,483
South Shields ...	Mar. 31, 1907	Mar., 1906	,,	10	21	252,171	134,061	118,110	155,422	15,145	133,360	7,653	2,531	23,992	46	24,038
Stalyb'ge, Hyde, Mossley, & D'k'f'd	Mar. 31, 1907	May, 1904	,,	27	57	325,270	259,470	65,800	258,177	9,318	244,028	15,442	...	38,766	39	38,805
Sunderland ...	Mar. 31, 1907	Aug., 1900	,,	19	40	304,086	294,461	9,625	289,691	14,825	233,485	52,094	...	72,054	342	72,396
Wallasey ...	Mar. 31, 1907	Mar., 1902	,,	12	55	140,436	138,150	2,286	138,917	10,950	127,918	10,723	18,592	42,254	630	42,884
Walsall ...	Dec. 31, 1906	Dec., 1902	,,	15 * 2	2 5	188,144	151,000	37,144	142,947	8,366	145,900	6,162	...	26,400	546	26,946
Warrington ...	Mar. 31, 1907	April, 1902	,,	9	52	128,050	100,446	27,604	101,615	10,530	89,721	10,831	1,530	19,204	336	19,540
West Ham ...	Mar. 31, 1907	Feb., 1904	,,	26	35	509,119	353,753	155,366	547,989	20,728	531,494	11,822	19,548	116,793	2,982	119,775
Wigan ...	Mar. 31, 1907	April, 1901	,,	24	70	461,570	459,670	1,900	515,212	20,712	465,985	55,168	...	61,101	1,368	62,469
Wolverhampton	Mar. 31, 1907	April, 1902	2	20 * 4	0 40	279,228	245,861	33,367	254,606	12,730	227,359	17,260 Motor O	18,051 mnibuses	43,183 2,375	640 45	43,823 2,420
Yarmouth (Gt.)	Mar. 31, 1907	June, 1902	E.	12	4	144,500	110,000	34,500	110,363	9,159	101,791	5,424	1,197	21,390	512	21,902

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast ...	Mar. 31, 1907	Nov., 1905	E.	73	18	1,225,448	1,060,000	165,448	1,072,445	14,646	1,060,000	22,256	13,000	177,832	3,307	181,139
Bexley ...	Mar. 31, 1907	Oct., 1903	,,	6	73	98,259	96,984	1,275	94,858	13,723	90,854	6,130	...	11,419	1,569	12,988
Birkenhead	Mar. 31, 1907	Feb., 1901	,,	23	79	366,266	357,854	8,412	357,991	14,914	306,891	50,964	11,025	54,252	1,156	55,408
Bournemouth ...	Mar. 31, 1907	July, 1902	,,	34 *10	35 0	381,554	381,554	...	401,668	11,664	368,221	35,518	24,999	83,663	360	84,023
Cardiff ...	Mar. 31, 1907	May, 1902	,,	36	50	802,039	732,383	69,656	767,109	20,948	689,467	73,808	9,277	106,551	12,564	119,115
Glasgow ...	May 31, 1907	Oct., 1898	,,	165 * 10	47 55	3,100,000	2,227,353	872,647	3,104,061	18,746	1,679,974	547,379	1,122,104	887,381	8,461	895,842
Huddersfield ...	Mar. 31, 1907	Feb., 1901	,,	33 * 3	0 20	646,284	398,957	247,327	412,902	12,512	325,819	82,507	44,360	78,115	3,081	81,196
Hull ...	Mar. 31, 1907	July, 1899	,,	27	15	488,673	436,543	52,130	436,543	16,057	436,543	67,357	74,775	121,186	...	121,186
Leeds ...	Mar. 31, 1907	Aug., 1897	,,	96	50	1,340,374	1,340,374	...	1,303,815	13,494	1,167,263	213,248	33,270	323,913	3,891	327,794
Leicester ...	Dec. 31, 1906	May, 1904	,,	37	0	734,838	678,805	56,033	677,829	18,320	651,645	46,672	41,448	114,752	1,776	116,528
London ...	Mar. 31, 1907	May, 1903	1	H100 E116	6 55	*	*	*	6,736,737	31,077	6,133,564	603,173	141,855	567,694 810,320	15,296 14,676	582,990 824,996
N'castle-on-Tyne	Mar. 31, 1907	Dec., 1901	E.	53 *6	0 10	1,413,989	1,164,028	249,961	1,153,972	21,773	1,029,992	152,476	43,515	205,262	3,392	208,654
Northampton ...	Mar. 31, 1907	July, 1904	,, H.	9 ...	6 ...	128,300 ...	127,255 ...	1,045 ...	127,374 ...	14,036 ...	115,546 ...	11,709 ...	2,113 ...	21,542 770	542 88	22,084 858
Portsmouth ...	Mar. 31, 1907	Sep., 1901	E.	28	40	672,272	661,714	10,558	670,157	23,514	618,341	100,715	48,695	98,911	3,103	102,014
Preston ...	Mar. 31, 1907	June, 1904	,,	17	16	224,102	187,269	36,832	187,269	10,888	167,775	14,487	9,907	37,796	150	37,946
Reading ...	Mar. 31, 1907	July, 1903	,,	13	15	231,658	231,658	...	220,783	16,742	204,993	22,548	7,466	32,661	972	33,633
Sheffield ...	Mar. 25, 1907	Sep., 1899	,,	56	28	1,163,646	1,133,770	29,876	1,172,279	17,683	970,620	136,278	74,245	276,907	2,679	279,586

E—Electric trolley system. H—Horse lines. C—Cable lines. * Indicates lines leased. † Lines on which running powers are exercised.
1 Horse, conduit, and electric. 2 Surface contact.
* Conferred by Annual Money Act, which limits amount for each financial year. Powers not exercised are lapsed.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name	Operating Expenses.					Net Income.	Additions to Net Income.	Deductions from Net Income.						Net Surplus + or Deficit −
	Traffic.	General.	Repairs & Maintenance.	Power.	Total.			Interest.	Sinking Fund.	Income Tax.	Depreciation & Renewal	Sundries.	Total.	
Aberdeen	16,734	6,548	6,008	9,361	38,651	28,036	4,134	10,985	3,515	...	16,737	933	32,170	...
Ayr	3,295	1,813	1,150	2,005	8,263	6,950	70	2,400	958	303	2,367	...	6,028	+ 992
Birmingham ...	27,311	9,298	6,028	25,602	68,239	68,185	...	18,447	6,547	...	14,660	16,531	56,185	+ 12,000
Blackburn	11,779	3,016	7,373	11,018	33,186	21,766	...	7,583	12,878	448	...	345	21,254	+ 512
Blackpool	10,648	3,646	6,199	9,399	29,892	21,614	3,480	8,590	6,349	113	6,042	...	21,094	+ 4,000
Bolton	25,322	6,443	13,209	16,589	61,563	49,731	753	12,993	13,573	..	14,693	146	41,405	+ 9,079
Bradford	62,245	19,909	31,785	45,644	159,583	72,524	3,232	25,020	29,484	2,543	4,536	4,173	65,756	+ 10,000
Brighton	13,047	3,652	6,558	11,243	34,500	16,153	...	8,579	5,164	...	...	...	13,743	+ 2,410
Burnley	14,251	4,833	6,971	15,237	41,292	21,512	...	5,855	4,834	...	8,766	2,057	21,512	...
Burton-on-Trent...	4,738	1,634	1,721	2,845	10,938	4,594	418	2,004	1,978	...	1,000	907	5,889	− 877
Bury	11,719	3,877	4,018	8,471	28,085	22,564	244	7,658	5,253	385	2,500	6,002	21,798	− 1,715
Chester	2,752	1,309	506	1,946	6,513	4,090	...	2,436	1,287	..	367	...	4,690	...
Chesterfield ...	2,691	635	769	1,882	5,977	5,515	...	4,060		133	...	...	4,193	+ 1,322
Colchester	3,669	1,285	1,169	3,117	9,240	2,127	...	2,485	1,732	...	...	...	4,217	− 2,090
Croydon	17,515	4,862	6,798	12,597	41,772	20,294	401	6,238	4,804	600	9,053	...	20,695	...
Darlington	3,551	671	881	2,235	7,338	3,805	35	2,437	1,941	...	...	...	4,398	− 558
Darwen	3,208	731	1,900	2,780	8,619	5,389	...	2,407	2,048	...	1,050	...	5,505	− 116
Derby	E 11,179 H 1,497	2,043 163	2,055 337	7,111 2,929	22,388 4,926	16,041 ...	548	5,657	2,387	...	...	615	8,659	+ 7,930
Doncaster	3,509	994	1,634	3,597	9,734	2,633	...	2,651	1,249	95	...	...	3,995	− 1,362
Douglas (I.O.M.) ...	4,019	1,756	2,546	5,322	13,643	7,891	...	1,959	885	...	2,000	2,650	7,494	+ 397
Dundee	14,020	3,748	6,138	11,498	35,404	22,268	...	8,236	5,330	300	8,316	...	22,182	+ 86
East Ham	12,901	3,039	6,185	6,847	28,972	18,116	583	5,632	5,054	248	...	2,599	13,533	− 104
Gloucester	5,472	1,402	1,527	2,654	11,055	3,978	...	5,363	2,259	...	...	836	8,458	− 4,480
Halifax	19,530	7,616	11,776	18,960	57,882	19,445	1,180	12,782	8,588	457	...	475	22,302	− 1,677
Ilford	8,206	2,430	2,207	4,286	17,129	8,261	1,666	4,804	3,949	...	792	382	9,927	...
Ipswich	7,645	1,732	2,249	4,501	16,127	5,915	...	4,157	1,753	...	...	...	5,910	+ 5
Keighley	2,523	548	465	1,656	5,192	3,048	90	1,331	1,554	...	253	...	3,138	...
Kilmarnock ...	2,990	747	638	1,925	6,300	2,303	...	1,886	151	19	...	652	2,708	− 405
Kirkcaldy	4,330	822	720	3,212	9,084	4,619	...	2,916	2,103	...	409	184	5,612	− 993
Lancaster	2,264	863	673	1,823	5,623	...	90	1,554	1,229	...	...	* 144	...	− 2,837
Leith	8,883	2,482	2,368	4,153	17,886	9,137	62	5,906	6,873	...	...	150	12,929	− 3,729
Lincoln	1,436	844	522	1,027	3,829	2,016	...	1,150	1,368	...	...	...	2,518	− 502
Liverpool	148,668	54,452	82,367	99,918	385,405	185,811	12,403	53,244	56,337	...	55,171	5,877	170,629	+ 27,585
Lowestoft	3,658	859	1,418	3,180	9,115	2,171	.	2,607	1,332	...	...	...	3,939	− 1,768
Maidstone	1,352	656	514	1,509	4,031	1,860	122	983	625	...	...	...	1,608	+ 374
Manchester ...	196,785	63,374	63,270	131,264	454,693	264,980	1,911	50,141	39,594	4,769	87,827	29,560	211,891	+ 55,000
Nelson	2,111	383	868	2,105	5,467	1,852	...	1,072	765	76	...	...	1,913	− 61
Newport (Mon.) ...	7,423	3,039	4,927	6,488	21,877	11,322	2,184	7,838	4,140	99	45	...	12,122	+ 1,384
Nottingham ..	33,457	12,553	12,563	22,483	81,056	58,937	...	15,889	16,493	...	...	2,811	35,193	+ 23,744
Oldham	20,089	4,317	8,148	21,582	54,136	39,942	1,110	12,436	13,227	277	..	6,447	32,387	+ 8,665
Perth...	2,505	677	140	1,741	5,063	3,333	47	2,634	1,892	2	...	...	4,528	− 1,148
Plymouth	6,811	2,728	5,153	7,170	21,862	9,404	1,225	4,624	4,727	...	...	1,278	10,629	...
Rochdale	13,656	2,323	4,361	9,165	29,505	24,633	...	10,448	6,907	772	...	3,613	21,740	+ 2,893
Rotherham... ...	7,566	2,215	2,171	6,899	18,851	8,885	1,463	3,737	2,260	...	4,201	150	10,348	...
Salford	61,281	14,543	21,165	45,177	142,166	90,385	4,439	20,452	18,691	1,446	14,889	26,346	81,824	+ 13,000
Southampton ...	14,032	4,495	7,024	11,019	36,570	14,434	...	6,222	5,192	212	2,535	273	14,434	...
Southport	4,508	1,648	1,832	3,238	11,226	7,257	6,325	6,434	4,946	...	1,977	150	13,507	+ 75
South Shields ...	5,038	1,852	988	4,260	12,138	11,900	111	4,504	2,859	...	2,531	2,117	12,011	...
Stalybridge, Hyde, Mossley, & D'kinf'd	14,906	3,737	4,117	9,180	31,940	6,865	...	8,949	6,115	...	...	...	15,064	− 8,199
Sunderland ...	18,417	5,406	4,159	12,840	40,822	31,574	704	8,751	9,014	469	6,259	661	25,154	+ 7,124
Wallasey	11,716	3,190	3,346	8,914	27,166	15,718	221	4,873	2,634	...	3,000	553	11,060	+ 4,879
Walsall	6,849	2,418	2,862	3,965	16,094	10,852	1,053	5,099	2,148	269	4,389	...	...	...
Warrington ...	4,996	1,460	2,178	3,813	12,447	7,093	127	3,195	2,715	...	...	...	5,910	+ 1,310
West Ham	39,667	7,858	9,084	15,810	72,419	47,356	162	14,902	7,444	650	7,722	2,810	33,528	+ 13,990
Wigan	15,416	8,038	10,560	14,807	48,821	13,648	...	18,450	10,260	...	...	1,330	30,040	− 16,392
Wolverhampton ...	780 10,014	116 3,313	858 3,793	409 7,417	2,154 24,537	266 19,286	... 719	... 7,808	... 4,130	... ...	... 5,783	... 359	... 18,080	... + 2,191
Yarmouth (Gt.) ...	6,547	1,859	1,922	3,942	14,270	7,632	...	3,376	1,962	...	...	...	5,338	+ 2,294

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast	54,732	12,296	20,277	15,953	103,258	77,881	111	34,339	21,175	...	13,000	...	68,514	+ 9,478
Bexley	3,229	1,314	1,645	2,658	8,846	4,142	127	3,132	1,810	...	...	...	4,942	− 673
Birkenhead ...	15,049	5,092	7,506	5,858	33,505	21,903	...	11,891	9,289	200	317	206	21,903	...
Bournemouth ..	22,562	6,175	10,134	14,570	53,441	30,582	1,874	12,185	12,756	...	...	6,664	31,425	+ 1,031
Cardiff	36,893	9,384	11,802	7,094	65,174	49,185	...	23,138	19,729	...	...	1,913	44,780	+ 4,405
Glasgow	245,021	86,791	122,126	31,318	485,256	410,586	3,510	63,769	49,777	9,932	168,408	51,931	343,817	+ 70,279
Huddersfield ...	18,959	3,931	12,086	5,065	40,041	41,155	303	12,185	9,808	806	12,427	1,206	36,432	+ 5,026
Hull	30,592	8,933	21,301	9,352	70,178	51,008	818	12,942	9,528	1,224	10,604	...	34,298	+ 17,528
Leeds	87,112	29,403	37,440	17,255	171,210	156,584	9,512	43,005	38,029	3,946	11,481	373	96,834	+ 69,262
Leicester	41,903	8,823	10,057	8,157	68,940	47,588	551	22,761	11,872	396	13,110	...	48,139	...
London	H 202,483 E 213,906	69,981 88,654	52,221 84,065	259,683 81,478	584,368 468,103	... 356,893	... 4,424	174,778	153,155	1,425	35,000	22,285	386,643	− 25,326
N'castle on-Tyne...	56,004	17,780	20,482	13,060	107,326	101,328	3,071	34,323	34,255	4,366	275	2,740	75,959	+ 28,440
Northampton ...	E 5,763 H ...	1,894 ...	1,339 ...	2,290 ...	11,286 1,248	10,798 ...	110 ...	... 4,353	... 3,728	... ...	... 1,355	... 472	... 9,908	... + 1,000
Portsmouth ...	26,501	7,660	6,029	5,565	45,755	56,259	353	19,697	16,217	1,109	6,261	4,303	47,587	+ 9,025
Preston	10,071	4,505	4,004	2,203	20,783	17,163	...	5,822	5,773	...	5,568	...	17,163	...
Reading	8,515	3,725	2,618	3,405	18,263	15,370	...	6,558	5,607	145	3,060	...	15,370	...
Sheffield	97,590	20,245	29,662	20,922	168,419	111,167	812	41,393	25,716	2,203	20,000	2,000	91,312	+ 20,667

H—Horse lines. E—Electric trolley lines. * Deficit on Revenue Account.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Appropriation of Net Surplus. Carried Forward.	Reserve.	Relief of Rates.	Population Served.	Car Mileage.	Passengers Carried.	Passengers Carried per Car Mile.	Average Fare per Passenger. d.	Average Journeys per Head of Populat'n per Annum.	Average Car Miles per Day per Car.	Average Total Revenue per Car Mile. d.	Average Traffic Revenue per Car Mile. d.	Traffic Revenue per Mile of Single Track.	Average Traffic Revenue per Annum per Head of Populat'n Served.	Operating Expenses per Passenger. d.	Percentage of Operating Expenses to Total Revenue. %
Aberdeen ...	..	...	...	167,000	1,529,682	17,676,008	11·55	·95	105·84	95	11·112	10·332	2,522	8/4	·52	54·57
Ayr...	...	992	...	33,000	378,884	3,603,789	9·51	·98	109·20	104	9·637	9·294	1,520	8/11	·55	54·31
Birmingham ...	12,000															
Blackburn ...	512	...	...	200,000	1,002,372	10,094,028	10·07	1·25	50	105	13·15	12·64	2,219	5/3	·80	61·01
Blackpool ...	...	...	4,000	...	958,836	8,304,218	8·66	1·58	...	109	12·89	12·65	2,380	...	·864	58·04
Bolton	...	...	9,079	221,000	2,411,969	23,410,690	9·70	1·14	105·93	111·21	11·07	11·03	2,650	10/5	·63	55·40
Bradford	...	...	10,000	324,000	5,167,261	46,728,977	9·043	1·17	144	104·09	10·78	10·566	2,347	11/5	·819	68·76
Brighton	2,410	...	...	128,095	1,118,590	10,759,310	9·62	1·09	84	87·68	10·86	10·49	2,844	7/8	·77	68·11
Burnley	...	...	...	165,000	1,205,830	11,967,498	9·92	1·31	73	100	12·50	12·35	3,159	7/6	·83	65·86
Burton-on-Trent	...	...	...	52,000	421,317	3,383,527	8·03	1·072	65	58	8·85	8·60	1,529	5/10	·78	70·42
Bury	...	...	2,725	124,726	1,276,227	9,944,897	8	1·22	79·73	123·33	9·525	9·500	1,854	8/1	·677	55·45
Chester	...	...	...	38,309	291,555	2,532,778	8·687	·97	66·12	92	8·731	8·460	2,854	5/4	·62	63
Chesterfield ...	922	...	400	38,000	275,417	2,302,097	8·36	1·13	60	125	10·01	9·58	1,900	5/9	·62	53
Colchester ...	...	...	...	40,540	353,331	2,514,589	7·11	1·02	62·02	86	7·721	7·327	1,522	5/4	·88	81·5
Croydon	...	...	...	154,342	1,502,408	13,514,918	8·99	1·08	87·56	103	9·915	9·76	3,125	7/11	·742	66·87
Darlington ...	...	...	...	50,000	372,912	3,169,036	8·5	·82	63·38	92·9	7·171	6·964	1,217	4/4	·5[illegible]	65·85
Darwen	...	...	...	41,864	240,893	2,562,234	10·63	1·2	61	71·09	13·956	13·277	1,861	6/4	·807	61·53
Derby	7,930	...	...	124,000	E. 849,248 H. 109,083	8,381,460 1,004,914	9·869 9·222	1·075 ·999	75·70	...	10·86 9·529	10·614 9·205	...	6/9	·64 1·17	58·26 113·71
Doncaster ...	...	...	...	41,500	495,404	2,753,506	5·55	1·05	66·35	122	5·991	5·828	1,143	5/9	·85	78·71
Douglas (I.O.M.)	397	...	...	...	H. 286,513 C. 121,333	2,161,667 700,227	7·017	1·696	...	70 Sum. 79 ,,	12·672	11·899	3,235	...	1·144	63·36
Dundee	...	86	...	164,500	1,162,792	15,554,905	13·3	·878	93	81	11·903	11·748	2,323	6/11	·546	61·38
East Ham ...	...	...	5,270	125,000	1,062,151	15,049,240	14·1	·74	120	108	10·64	10·492	3,638	7/5	·50	61·53
Gloucester ...	...	...	...	50,715	519,996	3,182,111	6	1·06	62·75	94·93	6·938	6·55	948	5/7	·83	73
Halifax	...	...	...	178,000	1,624,275	18,899,242	11·62	·97	106	78	11·425	11·228	1,474	8/6	·735	74·85
Ilford	...	...	...	70,000	645,117	6,586,754	10·2	·89	94	126	9·446	9·106	2,156	7/-	·624	67·46
Ipswich	5	...	...	73,000	654,253	5,289,006	8·08	·965	75·56	70·65	8·086	7·8	1,429	5/10	·73	73·16
Keighley	...	...	...	42,000	256,715	1,935,098	7·50	·994	46·07	100·41	7·704	7·497	1,312	3/10	·644	62
Kilmarnock ...	...	...	...	36,000	328,829	2,331,277	7·09	·84	64·76	98·80	6·279	6·018	1,492	4/7	·654	73·75
Kirkcaldy ...	...	...	...	34,063	466,919	4,640,618	9·939	·692	136·2	53	7·556	7·289	1,734	7/9	·47	66·29
Lancaster ...	...	...	...	44,600	194,577	1,353,681	6·96	·950	30·35	92	6·759	6·611	1,117	2/5	·997	108
Leith	...	...	...	113,251	861,162	8,519,563	9·9	·74	75·23	112	7·531	7·352	2,208	4/8	·504	66·22
Lincoln	...	...	...	52,500	137,186	1,437,946	10·48	·95	27·39	55	10·226	10·044	1,938	2/2	·64	65·50
Liverpool ...	...	...	27,585	770,000	12,115,934	122,094,528	10·07	1·108	158·56	106	11·315	11·168	5,421	14/8	·766	67
Lowestoft ...	...	...	...	31,000	343,190	2,622,922	7·64	1·00	84·61	67	7·89	7·65	1,827	7/-	·83	87·64
Maidstone ...	374	...	...	13,000	157,050	1,186,566	8·85	1·14	91·27	92·5	9·002	8·633	710	8/8	·81	68·44
Manchester ...	...	...	55,000	800,000	15,523,459	143,264,501	9·23	1·19	179	100	11·12	11·02	4,556	17/10	·76	63·18
Nelson	...	...	...	42,000	203,203	2,035,300	10·01	·86	48·46	93	8·645	8·580	1,881	3/5	·645	74·70
Newport (Mon.)...	1,384	...	...	75,000	772,753	7,760,404	10·04	1·007	100·81	100	10·311	10·108	2,245	8/8·15	·677	65·90
Nottingham ...	...	6,744	17,000	254,568	2,731,552	31,218,691	11·43	1·06	123	95·50	12·30	12·13	3,863	10/10	·62	58
Oldham	...	3,665	5,000	160,000	1,818,444	18,647,731	10·25	1·19	116·55	104	12·416	12·243	2,604	11/7	·697	57·54
Perth	...	...	...	34,000	229,551	1,681,188	7·32	1·14	49·45	91	8·779	8·349	939	4/8	·723	60·3
Plymouth ...	...	...	...	118,000	721,115	7,324,347	10·157	1·024	62·07	90	10·406	10·403	2,084	5/4	·72	69·92
Rochdale	2,893	...	...	102,614	1,201,364	9,749,202	8·11	1·32	95	105	10·814	10·753	1,804	10/6	·73	55
Rotherham ...	...	...	...	61,500	618,211	5,743,298	9·29	1·125	93·39	109·56	10·767	10·450	2,692	8/9	·788	67·97
Salford	...	...	13,000	350,000	5,268,933	43,614,123	8·27	1·27	124·6	115·5	10·594	10·594	3,102	13 3	·782	59·99
Southampton ...	...	...	...	117,300	1,143,085	9,437,396	8·256	1·251	80	70	10·709	10·421	3,050	8/6	·93	71·70
Southport ...	75	...	...	31,312	447,821	4,068,131	9·08	1·07	129·9	102·5	9·905	9·741	1,691	11/7	·66	60
South Shields ...	...	...	...	112,000	559,948	5,654,929	10·09	1·01	50·48	99	10·30	10·28	2,337	4/3	·515	50·59
Stalybridge, &c.	...	...	...	92,811	1,422,122	9,780,464	6·877	·951	101·88	95·03	6·548	6·542	1,399	8/4	·784	82·3
Sunderland ...	...	...	7,124	170,000	1,535,425	17,483,132	11·38	1·006	102	76·8	11·314	11·261	3,687	8/6	·56	55·66
Wallasey ...	1,539	...	3,340	65,000	862,123	7,995,451	9·27	1·27	123	81·4	11·94	11·76	3,330	13/-	·816	62·60
Walsall	...	...	...	100,000	611,687	4,814,657	7·592	1·316	48	102	10·572	10·358	1,955	5/3	·82	59·727
Warrington ...	...	1,310	...	83,000	429,786	4,965,296	11·55	·93	59·82	103·42	10·911	10·724	1,989	4/7	·60	63·7
West Ham ...	4,322	...	9,668	308,284	2,556,854	35,502,836	13·88	·789	115	87	11·243	10·963	5,159	7/7	·492	60·00
Wigan	...	...	...	61,000	1,452,458	11,269,947	7·76	1·26	185	83	10·32	10·09	2,456	20/-	1·04	78
Wolverhampton	2,191	...	...	100,900	966,133	9,276,023	9·601	1·179	91·93	90	10·886	10·727	1,763	9/-	·691	57·72
Yarmouth (Gt.)...	2,294	...	...	35,000	601,535	4,296,953	7·143	1·199	122·77	73·97	8·737	8·534	1,775	12/3	·798	65·15

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast	516	..	8,962	349,180	5,296,895	42,945,849	8·11	·99	123	128	8·21	8·06	2,436	10/2	·58	57
Bexley	...	...	...	16,300	268,619	1,737,204	6·46	1·70	106·58	...	11·604	10·202	1,652	14/-	1·22	68·11
Birkenhead ...	...	...	...	117,000	1,324,743	11,696,691	8·82	1·113	100·83	83·32	10·038	9·829	2,261	9/3	·687	60·84
Bournemouth ...	1,031	...	...	100,000	1,765,098	13,503,610	7·65	1·48	135	92	11·42	11·37	2,860	16/9	·95	63·65
Cardiff	4,405	...	...	164,333	2,624,504	24,438,164	9·31	1·046	148·71	99	10·893	9·744	2,910	12/11	·653	55·83
Glasgow	...	25,279	45,000 *	1,050,000	20,350,367	224,063,098	11·01	·95	213	101·20	10·565	10·465	5,035	16/11	·52	53·96
Huddersfield ...	5,026	...	...	120,000	1,794,691	15,252,150	8·50	1·22	127	112	10·79	10·38	2,770	13/-	·63	49·32
Hull	15,000	...	2,528	266,762	2,956,406	29,151,543	9·86	1·00	109	113·68	9·84	9·84	4,456	9/1	·58	57·89
Leeds	...	...	69,262	463,495	7,454,321	73,024,853	9·92	1·065	157·55	111·38	10·69	10·56	3,352	14/-	·563	52·23
Leicester	...	...	...	232,111	3,331,998	27,467,984	8·243	1·002	118	99	8·393	8·265	3,101	9/11	·60	59
London	...	...	...	...	H 13,862,718 E 16,267,579	131,165,027 183,062,063	9·46 11·25	1·04 1·06	... ...	82 106	10·093 12·171	9·828 11·955	5,762 6,944	... ...	1·069 ·614	100·24 56·74
N'castle-on-Tyne	...	14,856	13,584	300,000	4,263,174	45,506,468	10·67	1·11	152	106	11·75	11·56	3,873	13/8	·57	51·44
Northampton ...	... ...	... ...	1,000 ...	90,000 ...	E. 541,715 H. 31,864	5,216,883 184,072	9·63 7·77	·99 1·00	60 ...	90 ...	E. 9·78 H. 6·46	9·53 5·80	2,459 ...	4/11 ...	·519 1·624	E. 51·10 H. 145·27
Portsmouth ...	4,025	...	5,000	202,000	2,199,823	20,668,825	9·40	1·15	102·32	83	11·129	10·791	3,471	9/9	·531	44·85
Preston	...	...	...	120,000	904,582	8,459,742	9·35	1·072	70·5	132·92	10·068	10·028	2,197	6/3	·59	54·77
Reading	...	...	...	80,000	918,825	8,130,179	8·84	·96	110	112	8·78	8·53	2,476	7/10	·53	54
Sheffield	...	...	20,667	447,951	6,804,656	73,966,299	10·870	·898	165	104·6	9·861	9·767	4,174	12 4	·546	60·24

* Applied as special depreciation. H—Horse lines. E—Electric trolley system.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Average Operating Expenses per Car Mile (excludi'g Power Cost). d.	Average Operating Expenses per Car Mile (including Power Cost). d.	Average Number of Cars in Use Daily.	Number of Cars in Stock.	Average Speed per Hour. Miles.	Average Car Hours per Day.	Average Distance of 1d. Fare. Miles.	Average Fare Charged per Mile. d.	Operating Expenses per Car Mile. Traffic. d.	General. d.	Repairs and Mainten-ance. d.	Power. d.	Total. d.	Board of Trade Units.	Cost per Board of Trade Unit. d.	Board of Trade Units used per car mile.
Aberdeen	4·595	6·064	44	69	7	704	1·31	·81	2·625	1·027	·943	1·469	6·064	1,906,218	1·17	1·28
Ayr	3·964	5·234	10	19	8	130	1·25	·75	2·087	1·148	·729	1·270	5·234	375,436	1·28	·99
Birmingham ...																
Blackburn	5·38	8·02	26	48	7·50	364	1·25	·76	2·82	·72	1·76	2·64	7·94	1,853,272	1·43	1·64
Blackpool	5·13	7·48	24	61	6	400	...	...	2·67	·91	1·55	2·35	7·48	1,261,946	1·79	1·31
Bolton	4·47	6·12	58	96	7½	932	1·40	·70	2·518	·639	1·313	1·656	6·126	3,619,390	1·10	1·50
Bradford	5·292	7·412	136	239	7·20	2,040	1·59	·501	2·891	·925	1·476	2·120	7·412	9,582,871	1·14	1·8
Brighton	4·99	7·40	32	50	6½	512	1·31	·72	2·799	·784	1·407	2·412	7·402	1,798,905	1·50	1·61
Burnley	5·18	8·218	27	46	7	405	1·25	·83	2·836	·963	1·387	3·032	8·218	2,525,135	1·45	2·08
Burton-on-Trent...	4·61	6·23	9·79	20	6¾	181	1·35	·70	2·70	·93	·98	1·62	6·23	551,758	1·385	1·16
Bury	3·689	5·282	..	47	7·56	...	1·22	·83	2·204	·729	·756	1·543	5·282	2,042,840	·99	1·6
Chester	3·762	5·364	6·4	13	8	115	1·27	·79	2·265	1·078	·419	1·602	5·364	266,856	1·75	·91
Chesterfield ...	3·56	5·20	6	12	7·15	108	1·38	·75	2·344	·554	·670	1·641	5·209	361,421	1·25	1·31
Colchester	4·159	6·276	10·68	18	6·12	171	1·13	·97	2·492	·873	·794	2·117	6·276	498,758	1·50	1·41
Croydon	4·661	6·673	48	60	6·85	725	2·15	·52	2·798	·777	1·086	2·012	6·673	1,511,590	2·00	1·006
Darlington	3·284	4·723	11	16	6½	151	1·098	·82	2·285	·432	·567	1·439	4·723	429,105	1·25	1·15
Darwen	5·817	8·587	6	17	8·75	108	1·05	·81	3·196	·728	1·893	2·770	8·587	395,096	1·75	1·64
Derby	E. 4·318 H. ...	6·327 10·837	... ...	39 5	... ...	... ...	... ...	... ...	3·16 3·294	·577 ·358	·581 ·741	2·009 6·444	6·327 10·837	1,137,705	1·50	1·34
Doncaster	2·974	4·716	13	25	7·5	222	1·25	·8	1·7	·482	·792	1·742	4·716	575,470	1·50	1·16
Douglas (I.O.M.) ...	4·197	8·029	H 24 Sum. C 9 ,,	43 14	6	...	1·5 1·37	1·23 Sum. 1·45 ,,	2·365	1·033	1·499	3·132	8·029			
Dundee	4·934	7·307	42	60	6·2	528	1·468	·786	2·893	·774	1·267	2·373	7·307	2,207,559	1·25	1·8
East Ham	4·999	6·546	25	40	7	448	1·57	·64	2·915	·687	1·397	1·547	6·546	1,095,511	1·5	1·03
Gloucester	3·87	5·10	15	30	6·78	217	1·50	·62	2·526	·646	·705	1·225	5·102	637,491	1·00	1·21
Halifax	5·751	8·552	57	96	7·2	912	1·30	·77	2·886	1·125	1·740	2·801	8·552	3,033,499	1·50	1·87
Ilford	4·778	6·372	14	22	7·5	221	1·373	·74	3·053	·904	·821	1·594	6·372	897,916	1·146	1·392
Ipswich	4·265	5·916	19	36	6·30	216	1·53	·693	2·805	·635	·825	1·651	5·916	720,246	1·50	1·101
Keighley	3·306	4·854	7	12	7·61	126	2·35	·994	2·359	·513	·434	1·548	4·854	227,137	1·75	·88
Kilmarnock ...	3·193	4·598	9·11	14	7·43	121	1	·97	2·182	·545	·466	1·405	4·598	369,551	1·25	1·12
Kirkcaldy	3·305	4·956	18	22	6½	184	1·50	·64	2·437	·462	·406	1·651	4·956	685,269	1·125	1·467
Lancaster	4·687	6·936	6	12	8	96	1·019	·959	2·793	1·064	·830	2·249	6·936	240,820	1·817	1·238
Leith	3·828	4·985	21	37	7	315	1·56	·63	2·476	·692	·66	1·157	4·985	971,699	1·026	1·13
Lincoln	4·903	6·699	4	8	7	72	1·75	·428	2·513	1·477	·913	1·726	6·699	164,314	1·50	1·197
Liverpool	5·655	7·635	389	494	8	5,446	2·375	·43	2·945	1·079	1·631	1·980	7·635	20,381,934	1·177	1·682
Lowestoft	4·15	6·37	14	19	8	196	univ'rs'l penny fare		2·56	·60	·99	2·22	6·37	356,551	2·14	1·04
Maidstone	3·854	6·160	5	7	6·4	71·66	1	1	2·066	1·002	·786	2·306	6·16	206,932	1·75	1·31
Manchester ...	5·00	7·03	425	566	7·37	6,175	2·12	·56	3·04	·98	·98	2·03	7·03	25,072,791	1·259	1·61
Nelson	3·971	6·457	6	9	10	108	1	1	2·494	·452	1·025	2·486	6·457	252,546	2	1·24
Newport (Mon.) ...	4·779	6·794	26	40	6·67	390	1·62	·61	2·305	·944	1·530	2·015	6·794	1,153,398	1·35	1·49
Nottingham ...	5·14	7·12	77	115	6·50	15	1·62	·65	2·94	1·10	1·10	1·98	7·12	4,316,656	1·25	1·61
Oldham	4·297	7·145	48	80	6·50	864	1·12	·871	2·652	·570	1·075	2·848	7·145	3,453,037	1·50	1·89
Perth...	3·473	5·294	8	12	6·25	120	1·01	1·073	2·619	·708	·146	1·821	5·294	279,694	1·49	1·21
Plymouth	4·999	7·276	28	42	7·25	336	1·75	·75	2·267	·908	1·715	2·386	7·276	938,006	1·75	1·34
Rochdale	4·065	6·028	33	59	7	495	1·14	·95	2·725	·462	·878	1·828	5·893	1,896,278	1·16	1·69
Rotherham ...	4·640	7·318	17	31	8	272	1·6	·62	2·937	·860	·843	2·678	7·318	1,103,804	1·50	1·785
Salford	4·418	6·476	125	177	7·75	2,125	1·50	·59	2·791	·662	·965	2·058	6·476	7,983,603	1·358	1·53
Southampton ...	5·366	7·679	45	51	7	557	1·25	·75	2·947	·944	1·475	2·313	7·679	1,333,050	1·98	1·17
Southport	4·282	6·017	14	26	6·5	210	1·3	·72	2·415	·883	·981	1·735	6·016	504,385	1·50	1·16
South Shields ...	3·37	5·20	15	35	6·89	222	1·50	·62	2·16	·79	·42	1·83	5·20	710,234	1·44	1·27
Stalybridge, etc....	3·840	5·389	41	55	6·75	577	1·24	·8	2·515	·630	·695	1·549	5·389	2,203,128	1·0	1·549
Sunderland ...	4·374	6·379	45	70	7	726	1·44	·68	2·879	·845	·650	2·005	6·379	1,826,167	1·69	1·18
Wallasey	5·082	7·562	29	35	7	435	1·50	·62	3·26	·89	·931	2·48	7·562	1,316,215	1·62	1·82
Walsall	4·760	6·314	17	28	7	255	1·24	·83	2·687	·949	1·123	1·555	6·314	662,582	1·50	1·083
Warrington ...	4·821	6·950	11·386	21	6·46	182·17	1·25	·803	2·790	·815	1·216	2·129	6·950	610,115	1·50	1·42
West Ham	5·314	6·798	80	100	6¾	1,040	1·85	·56	3·723	·738	·853	1·484	6·798	3,797,337	·99	1·48
Wigan	5·62	8·07	48	67	8	960	1	1	2·543	1·33	1·75	2·45	8·07	2,369,000	1·50	1·63
Wolverhampton ...	4·252	6·095	30	43	6½	420	1·125	·867	2·487	·823	·942	1·843	6·095	1,582,325	1·125	1·638
Yarmouth (Gt.) ...	4·12	5·693	22	31	6	324	1	1	2·612	·742	·766	1·573	5·693	539,902	1·75	·897

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

															Works Cost.	
Belfast	3·96	4·68	123	220	8·75	1,931	2·33	·40	2·48	·56	·92	·72	4·68	6,434,835	·59	1·21
Bexley	5·529	7·904	...	18	7·5	...	1·31	·80	2·885	1·174	1·470	2·375	7·904	408,497	1·561	1·52
Birkenhead ...	5·009	6·07	43·55	59	7·128	509	1·38	·64	2·727	·922	1·360	1·061	6·070	2,398,274	·58	1·81
Bournemouth ...	5·29	7·27	57	81	6·61	1,026	1·16	·87	3·07	·84	1·38	1·98	7·27	2,676,833	1·306	1·51
Cardiff	5·311	5·95	87	130	6·80	1,104	2	...	3·374	·858	1·079	·64	5·95	4,842,074	·35	1·84
Glasgow	5·353	5·721	543·98	780	7·91	7,616	2·29	·45	2·890	1·023	1·440	·369	5·721	24,974,056	·301	1·23
Huddersfield ...	4·65	5·32	44·25	70	6·6	708	1·25	·82	2·52	·52	1·61	·67	5·32	3,722,598	·33	2·04
Hull	4·93	5·69	71·25	116	10	1,140	2·75	·36	2·48	·73	1·72	·76	5·69	3,582,831	·63	1·21
Leeds	5·02	5·68	186	270	7·21	2,790	1·95	·54	2·84	·96	1·22	·56	5·58	13,091,475	·32	1·78
Leicester	4·377	4·965	92	140	8	1,472	2·15	·493	3·018	·635	·724	·588	4·965	5,349,665	·358	1·60
London	H 5·622 E 5·704	10·117 6·906	466 420	723 671	6 8·5	6,291 6,300	... ...	... ...	3·506 3·156	1·212 1·308	·904 1·240	4·495 1·202	10·117 6·906	32,782,702	·596	2·02
N'castle-on-Tyne...	5·30	6·04	111	187	7	1,665	1·58	·68	3·15	1	1·15	·74	6·04	7,659,050	·41	1·80
Northampton ...	3·99	5·00	16·50	22	8·6	264	1·34	·68	2·55	·85	·59	1·01	5·00	878,889	·625	1·62
Portsmouth ...	4·384	4·991	73	100	6	15	1·50	·85	2·891	·835	·658	·607	4·991	2,230,460	·599	1·378
Preston	4·929	5·514	20	30	7·3	350	1	·95	2·671	1·195	1·063	·585	5·514	1,461,304	·362	1·409
Reading	3·88	4·77	25	36	7	400	1·47	·69	2·224	·973	·684	·889	4·770	1,090,416	·75	1·053
Sheffield	5·202	5·940	178·23	263	6·727	2,940	2·50	·38	3·442	·714	1·046	·738	5·940	11,546,500	·391	1·697

C—Cable line. E—Electric trolley system. H—Horse lines. * And general.

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LEGAL.

DUBLIN TRAMWAY COMPANY.

John Burns, a clerk, was, on December 3, awarded by a Dublin jury £250 damages in respect of injuries received while he was a passenger on the top of a car belonging to the Dublin Tramway Company. The averment was that he was struck by a trolley pole which swerved, and that he was seriously injured.

LONDON UNITED TRAMWAYS.

Before Mr. Justice Lawrance and a special jury in the King's Bench Division of the High Court of Justice on December 11, Mrs. Emma Sexton was awarded £300 damages against the London United Tramways Company in respect of the death of her husband. Sexton was driving a horse and cart in Uxbridge Road during a dense fog on the night of January 18 last, when, it was averred, a tramcar belonging to the defendants collided with the cart, and Sexton received injuries which caused his death. A stay of execution was granted.

PICCADILLY RAILWAY AND STAMP DUTY.

In the Court of Appeal on December 5 arguments were heard and judgment was given in an appeal by the Attorney-General *v.* the Great Northern, Piccadilly, and Brompton Railway Company. The action was brought by the Crown to recover £13,200 under the Stamp Act, and it was alleged that there had been a failure to state an increase of nominal capital of the company. The circumstances arose out of the amalgamation in the present company of the Great Northern and Strand and the Brompton and Piccadilly Circus Railway Companies. Duty had been paid on unissued capital of the Great Northern and Strand Company, and the Crown contended that this unissued capital now became the capital of the new company, and was liable to duty as such. The defendant company replied that there had been no increase of capital, and that an attempt was being made to exact duty twice over. Mr. Justice Walton found in favour of the defendant company, and the appeal was made. The Court of Appeal now held that Mr. Justice Walton had taken a mistaken view of the Act of 1902, under which the Brompton Company took over the Strand Company, and that the Crown was entitled to the sum claimed. The Solicitor-General stated that the £13,200 included penalties, and that the Crown would probably be satisfied if the company paid the duty, plus 3 per cent. interest and costs.

THE DUTIES OF PLAINTIFFS.

In Manchester County Court on December 2, Judge Parry again spoke out strongly on the subject of plaintiffs bringing exaggerated claims against Manchester Corporation in respect of injuries received in tramway accidents. Mrs. Helen Jenson sued the Corporation for £75, and her husband, Mr. C. C. Jenson, claimed £100, both of them having been injured in a collision between a car in which they were passengers and another car. The Corporation admitted liability, had paid sums into Court, but contended that the amounts sued for were excessive.

Judge Parry, in giving his decision in Mrs. Jenson's case, said that the particular complaint from which the plaintiff was now suffering had never been mentioned in the letters to the Corporation, so that they had not been able to make any inquiries about it. It was important that plaintiffs in such cases should state the whole of their injuries. Moreover, it was clear from the evidence that the plaintiff had not carried out her medical adviser's instructions to stay in bed for a month. If she had done that the damages would have been considerably less. The Corporation were entitled to say that people suffering from accidents should not neglect the ordinary duties of citizens. He would give the plaintiff judgment for £40, but each party must pay its own costs. Dealing subsequently with Mr. Jenson's case, his Honour said that in his opinion the chief thing the plaintiff was suffering from was a form of hysteria, and instead of sending him back to work as soon as possible his medical attendants had kept him in bed. In a number of matters the plaintiff had not been open and straight with the Corporation, and in the interests of the Corporation—who in these matters were only trustees for the ratepayers—he was bound to scrutinise such things closely. The conclusion he had arrived at was that, although the plaintiff had suffered some little injury in the collision, he had put forward a grossly exaggerated claim which he could not substantiate. The Corporation had in this case been too generous, and in awarding the plaintiff £25, with costs up to the date of the payment into Court, he would give the defendants leave to take back the remaining £25. The defendants, too, must have costs subsequent to the payment into Court.

THE RHONDDA TRAMWAY BRIDGES.

In the Court of Appeal on December 19, judgment was given in an appeal by the Taff Vale Railway Company from a decision by Mr. Justice Bray in the matter of an arbitration between the appellants and the Rhondda Tramways Company. The tramway company have powers to construct certain tramways which are partly situated on road bridges which cross the railway. The railway company's telegraph wires are carried over the bridges, and the question was whether the tramway company were entitled under their Act to alter th position of the telegraph wires so as to allow of the tramway trolley and guard wires being erected. The tramway company had offered to make the alteration at their own expense, but this was opposed by the railway company. Mr. Justice Bray decided in favour of the tramway company, and this judgment was now confirmed by the Court of Appeal. Their Lordships held that under their Act the tramway company had the right to alter the wires, and the right to enter on the railway company's premises in order to do so.

AN EXPENSIVE ACCIDENT.

In the King's Bench Division of the High Court on December 19, before Mr. Justice Darling and a special jury, Dr. R. R. Llewellyn, a medical gentleman, obtained £440 damages against the London County Council in respect of personal injuries, and of the death of a horse and the destruction of a brougham. The horse and brougham were run into by an electric car belonging to the defendants, and the plaintiff, Miss Fallowfield (a lady relative who was in the carriage with him), and H. G. King (the coachman) were injured. Judgment was also given for Miss Fallowfield for £80, and for King for £100. The defence was that the coachman was to blame in trying to cross the road in front of the car.

PERSONAL.

Mr. A. M. Mulliner, Stockport, has been appointed assistant electrical engineer to Eccles Corporation.

Mr. J. F. Simpson, tramways manager and electrical engineer to Preston Corporation, has had his salary raised by £50 per annum.

Mr. J. W. Gourlay, Neasden, has been appointed a shift engineer at the Stuart Street power-station of Manchester Corporation.

Mr. R. Q. Seymour has been appointed chief assistant at the Grantham electric lighting station of the Urban Electric Supply Company.

Mr. R. D. Spurr has been appointed resident engineer at the Ilkeston generating station of the Derbyshire and Nottinghamshire Electric Power Company.

Mr. H. G. Young, of the Musselburgh and District Electric Light and Traction Company, has been appointed manager and engineer of Bo'ness electric supply undertaking.

Mr. C. F. Metzger has removed his offices to 22, Cooper Street, Manchester. His telephone, No. 5892, and telegraph address, "Metzger, Manchester," remain the same.

Mr. H. E. Yerbury, chief electrical engineer in the Sheffield tramways department, is recommended by the Tramways Committee for an increase of salary from £400 to £450 per annum.

Mr. S. S. Foster, of the Derbyshire and Nottinghamshire Electric Power Company, has been appointed chief assistant at the Hoylake and West Kirby electricity works.

Councillor S. McCalmont Hill has been appointed vice-chairman of the Bournemouth Corporation Tramways Committee, in place of Councillor F. A. K. Hounsell, who has resigned.

Mr. C. J. Grimes, resident engineer at Devenport on electrification work at the dockyard for Messrs. Preece and Cardew, has received an appointment under the Commissioners for the port of Calcutta.

Mr. R. L. McCulloch has been appointed general manager of the Leamington and Warwick Electric Traction aud Lighting Company. Hitherto he has been traffic manager of the Merthyr Electric Traction aud Lighting Company.

Mr. Lorenzo W. Migotti, late of the Underground Electric Railways Company of London, Limited, has left London for Buenos Ayres to join Mr. Pakenham W. Beatty, who is head of the electrical undertakings of the Buenos Ayres and Pacific Railway Company.

Mr. J. Bowden has resigned his position as rolling stock superintendent of the London County Council Tramways in order to take up another appointment. Mr. W. E. Ireland, assistant rolling stock superintendent has been appointed to fill the vacancy at a salary of £400 a year. The resignation and appointment are more fully referred to in our report of the London County Council proceedings.

Councillor H. Kimber, J.P., who has been chairman of the Portsmouth Corporation Tramways Committee since the Portsmouth tramways were municipalised, and has devoted much time and attention to the work of the Committee, acting on medical advice, recently resigned the chairmanship of the Committee. Mr. Alderman J. H. Corke, J.P., who has hitherto acted as vice-chairman to Mr. Kimber, has been appointed chairman, and Councillor J. Timpson has been elected as vice-chairman.

Mr. Joseph Barton, for many years manager of the Wigan Tramways Company, died on December 7, after a long illness. Mr. Barton was born in Stockport in 1848, and received his training as an engineer with the Lancashire and Yorkshire Railway Company. In 1887 he was appointed manager of the Wigan Tramways Company, and on Wigan Corporation purchasing the undertaking he became superintendent of the works department in the central car-sheds. In both capacities he earned the highest opinions of his employers, and he was also a great favourite with the workmen.

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NEW CONTRACTS AND ORDERS.

Alton and Company have an order from Bristol Corporation for pipe work at Avonbank station at £2,326.

J. P. Hall and Company have had a tender for condensing plant at £865 accepted by Tunbridge Wells Corporation.

Callender's Cable Company have an order from Burslem Town Council for cable at £459.

Babcock and Wilcox are to supply Lowestoft Town Council with three mechanical stokers, two at £165 each and one at £235.

Edgar Allen and Company, Limited, have had a tender accepted by Sheffield Town Council for tramway points and crossings.

The Western Electric Company's tender for cable for an extension, at £164, has been accepted by Woolwich Borough Council.

Siemens Brothers, Limited, have a contract from Burnley Town Council to supply 1,600 yards of ·15 in. cable and 800 yards of ·075 in. cable at £270 12s.

Johnson and Phillips, Limited, have received orders from the Clyde Navigation Trustees for cables for the Renfrew workshops, and for the Rothesay Dock of the Trust.

Babcock and Wilcox, Limited, have been recommended by Southampton Electricity Committee as contractors for the supply of a boiler at £1,680.

L. P. Winby and Company have recently received an order from the Cardiff Corporation Tramways, for a supply of their "Winby" patent anchor chairs.

The Electric Construction Company have obtained an order from the Bengal-Nagpur Railway Company for a polyphase induction motor and two motors and shunt-regulating resistances.

Lord and Shand, Plymouth, have received an order for the construction of a high-pressure electric line from Bovey Tracey to Haytor for the lignite works of the Islington Mining Company.

The Electric Construction Company have obtained an order from Hammersmith Borough Council for a 60 KW. motor-generator at £300.

Callender's Cable and Construction Company have obtained a contract from Stoke-on-Trent Town Council for cables and accessories at £4,775.

Bermondsey Electricity Committee have recommended acceptance of tenders for cables from Callender's Cable Company and Johnson and Phillips.

Messrs. L. P. Winby and Company have recently received a repeat order from the Liverpool Overhead Railway Company, for a supply of their "Winby" patent anchor chairs.

The British Insulated and Helsby Cables, Limited, have an order from Halifax Electricity Committee for 770 yds. of ·3 sq. in. low-tension, paper-insulated, lead-covered cable at £166.

The British Westinghouse Company have obtained orders from the Treforest Electrical Consumers Company for a 3,000-KW. turbo-alternator, and from Tunbridge Wells Corporation for a 500-KW. turbo-alternator. The price of the latter is £2,575.

W. T. Henley Company's have secured an order from Stoke Newington Borough Council for laying mains at £623. The same company have had their tender accepted by Peterborough Town Council for cables at £1,250.

The Continuous Rail Joint Company, Limited, have been favoured with further orders (from the contractors, Messrs. J. G. White and Company, Limited) for the supply of their patent continuous rail joint for the Perth Tramways (W.A.), also for Dumbarton and South America.

The Continuous Rail Joint Company, Limited, have also received an order for their patent continuous rail joints for Llanelly from the contractors, Messrs. J. G. White and Company, Limited; also repeat orders for this fastening on Messrs. White's extensive work at Montevideo.

Wigan Tramways Committee have accepted the following tenders: Drivers' and inspectors' suits, Messrs. Coop and Company; inspectors', drivers', and conductors' overcoats, Messrs. Brown and Haigh; caps, Messrs. Lotery and Company; and mackintoshes, Messrs Mackintosh and Company.

Walsall Corporation have accepted tenders as under for the annual supply of stores to the tramway department: British Thomson-Houston Company, lamps and forged steel pinions; Magnolia Metal Company, bearing metal; Lambert Brothers, Walsall, trolley wheels; C. Richards and Sons, Darlaston, brake blocks.

Luton Corporation have accepted tenders as under: D. P. Battery Company, traction battery, £560; Lancashire Dynamo and Motor Company, automatic reversible booster, £245; Johnson and Phillips, traction switchboard, £257; Henley's Telegraph Works Company, supplying and laying 1,000 yards of feeder at 15s. 9d. per yard.

West Ham Tramways and Lighting Committee have agreed to extend for two years contracts with the British Westinghouse Company for the supply of transformers and meters, and with the Fuller Electrical Company for single-phase motors. The Committee also recommend a new contract with the British Westinghouse Company for two-phase motors.

Manchester Corporation have accepted the following tenders:

British Westinghouse Company.—Three 250-K.V.A. and one 25-K.V.A. transformers for sub-station at Messrs. Andrew and Bramall's mill.
Eckstein, Heap, and Company.—High and low-tension switch gear for sub-station at same mill.
Callender's Cable Company.—Vulcanised bitumen cables to June, 1909.
W. T. Glover and Company.—Lead-sheathed high-tension cable.

A Large Order for Thermit Joints.—Thermit, Limited, of London, inform us that their Australian branch has received an order for welding portions for 10,000 joints on the new tramway system being constructed at Adelaide. Thermit joints have already been used to a considerable extent in Sydney and other systems in Australia, and this order comes as the result of the satisfactory performance of the joints at those places.

Salford Tramways Committee have accepted tenders as under:

United Electric Car Company.—Twenty car bodies, at £448 12s. 6d. each.
Hurst, Nelson, and Company.—Four car bodies, at £458 17s. 6d. each.
Mountain and Gibson, Limited.—Twenty-three trucks, at £64 10s. each; one truck, at £110.
British Westinghouse Company.—Twenty-four electrical equipments, including trolley bases, at £279 each.
S. Rawlinson and Sons.—Four salt wagons, at £125 each.
General Electric Company.—Electric fittings at Salford Town Hall.

Messrs. H. Lotery and Company, of 4-8, St. Mary Street, London, N.E., have recently secured contracts for uniform clothing from, among others, the following: Edinburgh Tramways, F.I.A.T. Motor Company, Rover Motor Company, General Motor Cab Company, Rhymney Railway, Accrington Police, Guernsey Railway Company, Salop Asylum, Brighton Police, Wallasey Tramways, Bolton Police and Tramways.

The British Thomson-Houston Company, Limited, of Rugby, have received an order from the County of London Electric Supply Company, Limited, for a Curtis turbo-generator set of 2,500 KW. capacity, complete with sub-base condensing plant, for their City Road station, London. This is the fifth contract, and the sixth Curtis turbo-generator set ordered by the County Company from the British Thomson-Houston Company, Limited, aggregating 10,000 KW. in capacity.

Messsrs. Johnson and Phillips have received an order from the Waterworks and Electric Lighting Company, of Hankow, China, for the supply and erection of a complete equipment of a generating station of 1,500 KW. capacity, and for the outside mains, the total value being about £50,000. The same firm have contracts with Erith Urban District Council for overhead transmission lines, with Neath Rural District Council for cables, and with Bermondsey electricity department for 2,350 yards of triple concentric cable. Among other work which the firm now have on hand is the manufacture of high and low-tension cables for the electric equipment of the Victoria to London Bridge section of the Brighton Railway.

Stepney Borough Council have, in addition to some informal tenders, received the following offers for the supply of plant for a new generating station and sub-station: Boiler house equipment, Babcock and Wilcox (recommended), £8,523; generating plant: British Westinghouse Company, (1) £27,630, alternative £27,680; Willans and Robinson (recommended at £28,140), (1) £27,440, (2) £28,140; C. A. Parsons and Company, (1) £27,723, (2) £28,267; Richardsons, Westgarth and Company, Limited, £28,380 (without vacuum augm.); Siemens Bros. Dynamo Works, (1) £28,056, (2) £28,820; Brush Electrical Engineering Company, (1) £30,341, (2) £30,491; General Electric Company, £27,634; British Thomson-Houston Company, £9,700 (part only).

London County Council have approved of contracts as follows: India Rubber, Gutta Percha, and Telegraph Works Company, 600 rubber plough bases at 56/- each, and 1,200 plough leads at 4/3 each; Hadfield's Steel Foundry Company, extension of existing contract for special track work so as to include Caledonian Road and Seven Sisters' Road tramways, £4,000; J. E. Spagnoletti, extension of existing low-tension switchboard contract so as to include panels for feeding the same tramways, £200; General Electric Company, motor generator, £1,608; George Wimpey and Company, track construction of Hammersmith to Harlesden tramways (overhead wire system), 6¼ miles single track, £32,685; Hadfield's Steel Foundry Company, special track work for same tramways, £1,667; Walter Scott, Limited, 2,600 tons of track rails and fastenings, £19,691; P. and W. MacLellan, Limited, 136 tons flat bottomed rails and fastenings for car sheds, £1,073; Hurst, Nelson and Company, 50 car under-frames, £1,975. Details of the tenders submitted will be found in our report of the meetings of the Council.

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TRAMWAY AND LIGHT RAILWAY NOTES.

BELFAST.—At a meeting of Belfast Tramways Committee on December 9, a letter was read from the Board of Trade asking if suitable notice had been taken by the Corporation with reference to the accident that occurred on the Cliftonville Road in connection with the recent runaway case. The general manager recommended to the Committee that they should instruct him to reply and state that the men who left the car on the occasion referred to had been dismissed, and therefore in their opinion sufficient punishment had been meted out for the offence. This course was agreed to.

BIRKENHEAD.—The third annual concert in aid of the Birkenhead Tramway Employees' Benevolent Fnnd was held in the Town Hall, Birkenhead, on December 5, and proved very successful. There was a large attendance.

BIRMINGHAM.—The Small Heath Park and Nechells tramway route was opened for public service on December 5. With one exception this completes all the authorised lines in the city.—Mr. Alfred Baker, general manager of Birmingham Corporation tramways, delivered a lecture to the Birmingham and Midland Institute Scientific Society on the mechanical and electrical features of the city tramways. In the course of his address he emphasised the fact that the overhead wire system was still the cheapest and most efficient which had yet been devised. In this connection he pointed to the results of the high expenditure on the conduit system in London, where in spite of the great traffic and the large surplus over working expenses very little profit remained after paying interest and the instalment to the sinking fund. It was expected that the profits in Birmingham would far exceed those in London, for though the traffic was smaller the capital expenditure was only about one-sixth of that of London. Of the different methods of overhead construction, he regarded the span wire system as the best, as it gave steadier running and was the neatest. He was carrying out tests on new brakes, and he thought that Mr. Maley's brake, which was being adopted in Leeds, promised to be "fool-proof." If it continued to be satisfactory after an extended trial, he would recommend the Tramways Committee to use it on the steep gradients of the city.

BRIGHTON.—The Town Council have almost unanimously rejected a proposal that the engineer should report on the practicability of running tramways from west to east, *via* Western Road, North Street, and St. James' Street.

DERBY.—The new sections of Derby tramways in Ashbourne Road and Uttoxeter New Road were opened for public service on November 28. Eight new cars were brought into use.

GLASGOW.—The Tramways Committee of Glasgow Corporation have considered the question of instituting a service of workmen's cars, to be run within specified hours, at lower rates than ordinary fares, and now recommend that in view of the whole question of car fares having been from time to time considered by the Tramways Committee and the Corporation, and in view of the fact that the ordinary fares are at present lower than the statutory fares for workmen's cars, no action be taken in the matter.

HARTLEPOOL.—The Hartlepool Electric Tramway Company are now issuing cheap weekly tickets for the benefit of workmen and workwomen. The tickets are available for specified numbers of journeys on the various routes of the company's system. The workmen's universal ticket is available for 22 single journeys in a week on any route at the rate of 1s. 3d. This allows four journeys per day from Monday until Friday, and two on Saturday. Twelve single journeys per week on any one route can be had at the rate of 9d. This will allow two journeys per day from Monday to Saturday. In each case the tickets may be used between the hours of 5 a.m. and 8 a.m., 12 noon till 2 p.m., and 5 till 6 p.m.; Saturdays, 5 a.m. till 8 a.m. and 12 noon to 2 p.m. Workwomen's tickets are available for 22 single journeys on the Hartlepool or Seaton routes for 2s., allowing four per day, with the exception of Wednesday, when two journeys will be allowed. Tickets can be obtained allowing 12 single journeys per week (two per day) at the rate of 1s. 3d.

HASTINGS.—At a meeting of Hastings Town Council on December 13, a letter was read from Mr. T. B. Holliday, manager to the tramway company, replying to a complaint, and stating that everything possible would be done to prevent any overcrowding of the cars. Mr. Holliday, however, pointed out that it was impossible to prevent the trouble occasionally. Dr. Gray, a member of the Council, quoted from THE TRAMWAY AND RAILWAY WORLD to show that it was not dangerous to allow a few passengers to stand inside the cars. It was agreed to accept the explanation of Mr. Holliday and to express satisfaction with it.

KEW.—The prospects of the London United Tramway Company's Bill in next session of Parliament for the construction of a tramway across Kew Bridge, and the electrification of the horse line from the bridge to Richmond are to a large extent assured. At a meeting of Richmond Town Council on December 10, it was agreed formally to ask the company to promote a Bill for the purpose, in accordance with an agreement of 1902 between the company and the Corporation.

KIRKCALDY.—At a meeting of Kirkcaldy Town Council on December 9 Mr. Thom called attention to the speed at which the cars were being run. He said that when they agreed to the arrangement of running the cars as suggested by Mr. J. B. Hamilton he did not understand that they were to increase the speed of the cars. He understood 20 minutes was allowed to run the cars from Gallatown to Whyte's Causeway, about 2½ miles, and with 18 or 20 stopping places. It was practically impossible to run the cars through the average traffic and take up and set down passengers in the time allowed. Under these arrangements, when a car was so unfortunate as to get passengers, it got behind the result being that the cars were soon running in procession, one close behind the other. They were practically encouraging furious driving. He moved that the cars should be allowed half an hour instead of twenty minutes. Mr. Herriott proposed that the matter be remitted to the Tramways Committee, with a suggestion that they should put on an extra two cars. He said it was no uncommon thing to stand from 20 to 25 minutes waiting for a car. Mr. Fergusson, convener of the Tramway Committee, said to put on two extra cars would cost the Corporation over £1,000, and the saving to be effected through this new running arrangement would be entirely swept away. He said the running of the cars bore out that the cars had time to do the running in normal times. They were really carrying more people now than at the same time last year, and were taking more per car mile. Looking to the fact that they were trying to run the tramways on commercial lines, and trying to get ends to meet, the Council would be well advised to allow this matter to run for a season till the Committee made up their minds on the advantages of the present system, compared with that which was in force last year. Mr. Gray thought there were too many tramway managers. They should give the new arrangement a fair trial. It was ultimately unanimously agreed to give the present arrangement a further trial.

LEEDS.—A discussion took place at a meeting of Leeds Town Council on December 4 in reference to the proposed amalgamation of the Tramways and Electricity Committees, and the overwhelming majority of the Council were in favour of the new arrangement. A motion was carried instructing the new Committee to report not later than February as to the manner in which the powers and duties to be delegated were to be exercised and carried into effect. In the discussion reference was made to friction in the past between the two Committees, and it was contended that benefits would accrue from consolidation.

LEICESTER.—We have received the second annual report of the Leicester Tramways Ambulance Division, containing a record of work done, on which the members are to be congratulated. Forty-one cases of accident have been treated by the members, several of which occurred at the power-station and car depôt. First-aid cabinets are fixed at the various depôts, and they have frequently been called into use. A new learners' class was commenced at the beginning of the year, and out of the number (14) entered for the examination, 13 passed. At the last presentation of certificates the president, Mr. T. R. Smith, tramways engineer, emphasised the importance of the need of ambulance work in connection with tramways departments, and claimed that very few tramway systems in the country had such an efficient body of men as they had in Leicester. The Tramways Committee have shown their appreciation of the work of the division by providing a distinctive badge for its members.

LIVERPOOL.—Mr. C. W. Mallins, traffic superintendent of the Liverpool Corporation Tramways, informs us that his new sanding apparatus, which was described in our issue of January 10, 1907, has been fitted to 300 of the Liverpool cars, and the working of it is satisfactory. It is giving a greater degree of confidence to motor-men, and it is believed that a considerable number of accidents have been avoided by its use. An arrangement is made for sanding the track in the case of a car running backward, and with this additional security it is claimed that with the exercise of reasonable care it is impossible for a car to get out of control.

MANCHESTER.—The Tramways Committee on December 10 considered an application by drivers and guards for certain concessions, and they granted the following: (1) That spare men standing by should be paid for the first complete hour and for every complete half-hour afterwards. (2) That the drivers and guards engaged on the workmen's part-day cars, where such cars are only working eight hours per day, should be paid for the full day of nine hours. (3) That the drivers and guards should be paid overtime at the rate of time and a quarter for all hours over nine per day, or 54 hours per week.—A gathering of Manchester tramway employees took place at the Queen's Road depot on the evening of December 6, when Alderman Bowes, chairman of the Tramways Committee, presented a number of ambulance certificates, badges, medallions, and labels to the tram drivers and guards. Mr. Bowes congratulated the members on the fact that all who had entered the examination had been successful. The Tramways Employees Social and Athletic Society, which had formed football, cricket, billiard, ambulance, swimming, and fishing clubs amongst the members, was evidently in a flourishing condition, and he wished it every success. The Tramways Committee were at all times willing to meet the men on any grievances they might have

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in a friendly spirit. They should be reasonable in their demands. Alderman Bowes also proposed a vote of thanks to Mr. McElroy, the general manager, for presiding. No tramway undertaking in the country had a better general manager, or one who studied the interests of the employees more, than Mr. McElroy.

MIDDLESEX.—An extension of the Middlesex and Hertfordshire light railways from the Edmonton and Enfield boundary to Waltham Cross was formally opened on December 11. Sir C. F. Cory Wright and other members of the Middlesex County Council travelled on the first car.

NEWCASTLE.—At a meeting of Newcastle Tramways Committee on December 13, it was agreed to give employment to a motorman who had been suspended on account of an accident in Pilgrim Street. The man left himself entirely in the hands of the manager, and the Committee agreed to give him a place in the washing and cleaning department, where by good conduct and work he may rise to his old position again. Two other motormen who complained afterwards that brakes were defective, but did not report them on their day sheets, were censured. Every motorman in future is to enter up remarks on the column provided for that purpose.

SALFORD.—The Town Council have applied for authority to raise a loan of £20,000 for the purchase of cars, salt wagons, and sand-drying apparatus.

SHEFFIELD.—At a meeting of Sheffield Trades Council on December 13 a resolution was unanimously adopted, expressing the opinion that it is the duty of the Tramways Committee to grant men the right of appeal from the decisions of the general manager, and calling upon the City Council to take the necessary steps to give all employees the right to a fair hearing. The resolution came from No. 3 branch of the Tramway and Vehicle Workers' Union, and was moved by Mr. H. Stockton, who contended that tramwaymen had been unfairly treated by the general manager for trivial offences. They had been reduced on the uncorroborated evidence of a single person. "Touts," he said, at the termini at nights made secret observations, and presented reports to Mr. Fearnley, who acted upon them. The reply to the position taken up by the Trades Council is that the men have already a right of appeal to the Committee. The *Sheffield Telegraph* states that the move is part of the ceaseless endeavour that is going forward to make the Corporation a mere tool in the hands of the trade unions.

SUNDERLAND.—Sunderland Town Council have adopted the following recommendation of the Tramways Committee: That with the approval of the Board of Trade the following work be executed, the cost to be debited to the tramways revenue appropriation account: The existing single line of tramways in Ryhope Road, from Villette Road to Laurel Terrace to be doubled; so soon as the widening of Ryhope Road, from Laurel Terrace to Spelter Works Road, is carried out, the existing single line of tramways between these places to be doubled.

WIGAN. At a recent meeting of Wigan Tramways Committee a bonus scheme for drivers and conductors to the following effect was adopted: To each driver and conductor who during the previous quarter has been (1) free from suspension, (2) free from collisions or damage to car for which he is held to be blameworthy, (3) free from passengers' or public complaint for which he is held to be blameworthy, (4) not more than twice late on duty, and (5) free from report for neglect in the matter of collecting fares, a bonus to be paid as follows—After one year's service at the rate of 6d. per week, with one merit stripe; after two years' service, 9d., with two stripes; and three years' service, 1s., with three stripes, which stripes will be liable to subsequent forfeiture for any offence which would, if committed prior to the earning of the stripes, have prevented the holder thereof from gaining the same. The scheme further provides that a bonus for motormen in connection with current consumption is to be paid at the end of each financial year in which a reduction in the current consumed per car mile has been effected in comparison with the previous year. Five per cent. of the sum represented by any saving of current is to be divided equally amongst all motormen in the service at the end of each year, who have been so employed for not less than six months in such year.

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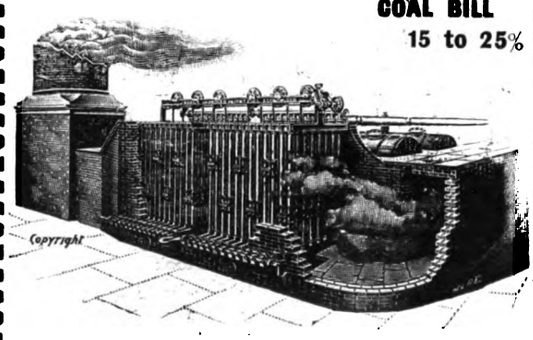

Patentees and Sole Makers—

E. GREEN & SON, LD., Wakefield, Manchester, London, and Glasgow.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS.

Applications for Letters Patent have been filed:

26,027 Brakes for railway carriages and tramcars—W. Thomson.
26,038 Rail joints—W. D. Williams.
26,039 Rail joints—J. F. Bastel.
26,089 Current collector for electric traction systems—A. West.
26,254 Ball bearings for bogie or sub-trucks for railway and tramway vehicles—F. L. Walker.
26,313 Life-guard for tram cars and motor omnibuses—P. Bisset.
26,382 Tramway rails—T. Hollins, E. Hollins, and J. Jinks.
26,395 Apparatus for re-wheeling rolling stock—J. A. Bell and T. Wilkinson.
26,399 Compound tramway rails—J. S. Pullen.
26,532 Shifting points for tram-lines—O. Coates.
26,536 Tramway rails—J. H. Briggs.
26,544 Controlling and preventing excessive speeds and side-slips of trams and motor cars—H. Fotherby.
26,640 Chairs for rails and rail joints—F. G. Watkinson.
29,643 Electric systems of railway signalling—H. Leitner.
26,757 Mudguard for motor omnibuses—P. Button.
26,788 Anti-skidding apparatus for motor 'buses—R. Josey.
26,891 Brakes for tramway and railway vehicles—H. Johnson.
26,923 Trolley heads for overhead tramway systems—W. F. B. Brown.
26,986 Apparatus for guiding the contact-pulley on overhead electrically propelled tramway cars—T. Brown.
26,993 Trolley wheels—W. P. Thompson.
27,012 Rail clamp—C. Lean (*Cornel Esser*).
27,092 Improvements in electric traction—H. B. Elliot.
27,241 Tramcars—P. Kavanagh.
27,363 Trolleys or collectors for electric railways and tramways—H. J. Tompkins.
27,378 Braking of tramway vehicles and slipper blocks for slotted tram rails—J. Hill.
27,405 Destination indicators for railway and tramway vehicles—G. C. Beall.
27,422 Device to release tramcar hand-brakes when the magnetic or rheostatic brakes are applied—A. W. Malcolm.
27,658 Mounting of railway and tramway vehicles on their wheels—C. de Bange.

SPECIFICATIONS PUBLISHED.

1906.

24,250 Prevention of side-slip of the wheels of motor omnibuses—Thomas.
25,557 Track brakes for electric tramcars—Mountain and Gibson, Limited, and Head.
25,775 Ventilators for railway vehicles and tramcars—Beresford.

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25,863 Current-collecting devices for electrically-propelled vehicles—British Thomson-Houston Company *(General Electric Co.)*.
27,302 Electric distribution systems for electric railways—British Thomson-Houston Company and Woodbridge.
27,670 Life-guards for motor omnibuses—Bennett.
27,672 Electric cranes—H. Pieper.
27,849 Single-phase motor control—The British Thomson-Houston Company, Limited. *(General Electric Company, U.S.)*
27,956 Axle bearings L. J. Aldridge.
27,958 Tramcar brakes—W. Thomson.
27,989 Electric railway installations—E. Woltmann.
28,017 Brakes for tramway and railway vehicles—S. Rhodes and L. Smithies.
28,085 Non-skid for motor car and 'bus wheels—W. L. Bragg.
28,157 Covering and protecting seats on tramcars and omnibuses—C. E. P. Gabriel.
28,164 Traction wheels for electric tramcars—Mountain and Gibson, Limited, and W. Renison, Jun.
28,202 Railway rail joints - J. M. Steele.

1907.

7,758 Guard for trolley wheels of electric tramcars McMorran.
20,549 Auxiliary guard rails to tramway track rails—Holt and Rhodes.
23,201 Tramway lines—Wolff.
2,590 Safety appliances for railway cars—Andrew.
4,867 Axles boxes for railway and tramway vehicles—Walsh.
9,496 Rail joints—Bleicher.
959 Trucks or bogies of railway and tramway vehicles—Panton.
2,533 Apparatus for milling tramway rails—Moorwood and Moorwood.
6,634 Wheel tyres for motor omnibuses—Hall.
9,040 Tramway and railway rails—Metz.
17,393 Joint for tramway and railway rails - Mitford.
6,894 Lubrication of axle-boxes—Smith and Heald.
13,140 Controlling and operating motors for electric railways—Sahulka.
14,905 Tramway brakes - Lewry.
15,219 Driving-gear of electric tramcars—Lironi.
16,732 Conduits for electric tramways—Manders and Hodge.
20,300 Pneumatic distributing systems for electrically-propelled vehicles—Allgemeine Elektricitats Gäs.
21,633 Railway joints—Richards.

Ipswich and Halfpenny Fares.—After considerable discussion Ipswich Town Council have by a large majority rejected a motion for giving a three months' trial to halfpenny fare stages on the tramways. Those who opposed the motion pointed out that the working classes already had the benefit of halfpenny fares, and that other towns of moderate size which had tried halfpenny stages for all passengers had found that that system did not pay,

Track Doubling at Huddersfield.—Huddersfield Town Council have agreed to a proposal by the Tramways Committee to double several sections of single track during 1908, at an estimated cost of £12,000. Alderman Aston, chairman of the Tramways Committee, stated that it was hoped the money would be provided partly out of profits on the current year's working and partly out of the renewals fund, which stood at £34,000.

A Pontefract Deadlock.—The Town Council of Pontefract at a meeting on December 20 made another attempt to get over a difficulty whereby tramway cars are prevented from running into the centre of the town. The Board of Trade had declared that Front Street was too narrow for a tramway service, and early in November the cars had to cease running through it. The Board of Trade inspector had, however, indicated that the difficulty might be got over by the simple expedient of throwing a strip, about five inches wide, of one of the footpaths into the carriage way. At the meeting of the Council, Mr. Holmes moved that the concession should be granted to the tramway company, but after a long discussion an amendment, moved by Mr. Wilson, that the company be asked to meet the Council with a view to the arrangement of a joint scheme of street widening, was carried by 12 votes against 10. The company have already intimated that they cannot possibly embark on any such scheme, so that the deadlock is likely to continue. The situation is a fresh example of the inconvenience to the public caused by a local authority attempting to extort conditions from a tramway company. The local public may well pray to be saved from their friends.

WANTED.

OLD STEEL TRAMWAY RAILS.

Wanted to purchase 500 tons of Old Steel Tramway Rails, 6 × 6, or 7 × 7. Apply Marple and Gillott, Limited, Engineers, Sheffield.

Mr. JOHN E. RAWORTH,
Chartered Patent Agent,
QUEEN ANNE'S CHAMBERS,
BROADWAY, WESTMINSTER.

A DEMONSTRATION.

On January 10th, by the courtesy of the Chairman and the General Manager of the West Ham Corporation Tramways, a demonstration of a car fitted with the Warner steering control will be given at the Greengate depot, near Plaistow Station, on the District Railway.

Tickets may be obtained from the Secretary, The Warner Engineering Company, 11, Dartmouth Street, Westminster, London, S.W.

CONDENSING PLANT.

The Mirrlees Watson Company, Limited, of Glasgow, make a special feature of the manufacture of Independent Condensing Plants having either Wet or Dry Air Pumps, and suitable for working in connection with Reciprocating Engines or giving the high vacuum desirable with Steam Turbines.

TRAFFIC RETURNS.

TRAMWAYS AND OMNIBUSES.	1906. WEEKS ENDING. Nov. 24.	Dec. 1.	Dec. 8.	Dec. 15.	1907. WEEKS ENDING. Nov. 23.	Nov. 30.	Dec. 7.	Dec. 14.	AGGREGATE. Wks.	1907.	Increase or Decrease.
	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	1,140	1,200	1,266	1,158	1,135	1,232	1,249	1,192	28	40,495	- 1,489
Ayr Corporation	169	170	168	166	186	173	181	178	31	10,350	- 132
Bath Electric	660	685	644	614	613	600	592	594	50	39,149	- 1,804
Belfast City	3,238	3,470	3,385	3,229	3,481	3,370	3,455	3,460	37	136,118	+ 8,759
Birmingham Corporation	...	...	...	...	6,131	6,281	6,489	6,378	37	227,859	—
Blackburn Corporation	862	998	884	869	1,016	981	987	1,002	37½	41,980	+ 2,844
Blackpool and Fleetwood	186	208	163	200	215	206	205	172	24	22,647	- 976
Blackpool Corporation	330	321	311	287	348	320	308	322	36	46,956	- 1,284
Bolton Corporation	2,027	1,996	1,977	1,847	2,074	2,048	2,116	2,091	37	84,690	+ 5,233
Bournemouth Corporation	1,226	1,292	1,226	1,173	1,287	1,246	1,320	1,337	36½	64,865	+ 1,343
Bradford Corporation	4,147	4,292	4,088	3,944	4,114	4,293	4,220	4,159	37	172,839	+ 3,477
Brighton Corporation	753	722	718	654	687	677	685	678	37	34,916	- 3,026
Bristol	4,656	4,764	4,544	4,543	4,559	4,568	4,647	4,462	-	-	-
British Elec. Trac. Co's. Undertakings											
Airdrie	211	236	200	203	228	220	224	227	49	11,111	+ 54
Barnsley	142	155	148	144	174	157	159	166	49	8,288	+ 225
Barrow	224	221	209	207	223	224	213	228	49	12,690	- 196
Birmingham and Mid. Joint Com.:											
Birmingham and Midland	...	...	...	...	801	817	804	...	48	39,584	—
City of Birmingham	...	...	...	...	2,767	2,771	2,835	2,794	49	138,765	—
Dudley-Stourbridge	762	782	765	782	750	772	736	794	49	43,654	- 29
South Staffordshire	772	812	784	781	897	886	846	902	49	44,624	+ 3,467
Wolverhampton District	419	411	410	402	429	442	431	444	49	22,701	+ 1,208
Cavehill	46	54	48	41	58	53	57	50	49	4,126	- 221
Devonport	407	409	409	406	407	405	415	418	49	22,602	- 243
Gateshead	951	974	975	954	971	1,005	982	1,028	49	49,881	+ 1,349
Gravesend and Northfleet	208	210	210	195	208	207	205	205	49	12,071	- 3
Greenock-Port Glasgow	487	546	545	540	526	505	497	492	49	32,080	- 603
Hartlepool	258	250	238	233	239	251	238	237	49	14,259	- 630
Jarrow	...	...	91	83	105	102	103	103	49	5,931	—

(Continued on page 38).

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TRAFFIC RETURNS—*continued.*

TRAMWAYS AND OMNIBUSES.	1906. WEEKS ENDING. Nov. 24.	Dec. 1.	Dec. 8.	Dec. 15.	1907. WEEKS ENDING. Nov. 23.	Nov. 30.	Dec. 7.	Dec. 14.	AGGREGATE. Wks.	1907.	Increase or Decrease.
British Elec. Trac. Cos.—*continued.*	£	£	£	£	£	£	£	£		£	£
Kidderminster	89	89	89	86	97	91	87	89	49	5.864	− 90
Leamington	167	115	119	112	177	126	123	129	49	8.018	− 572
Merthyr	193	188	186	183	206	207	209	211	49	10.455	+ 579
Metropolitan Electric	3.024	3.156	3.205	2.976	4.315	4.304	4.428	4.430	49	230.606	+ 63.008
Middleton	276	292	284	263	302	286	299	305	49	17.399	+ 3
Oldham-Ashton	538	558	546	533	559	533	524	548	49	29.801	+ 1.166
Peterborough	97	95	95	94	105	105	103	107	49	6.297	− 126
Potteries	1.839	1.883	1.904	1.869	1.907	2.053	1.936	1.985	49	93.785	+ 2.912
Rothesay	43	42	38	37	42	39	42	67	49	10.352	− 527
Sheerness	48	47	48	46	49	48	48	49	49	2.907	− 61
South Metropolitan	622	633	621	504	688	650	688	657	49	39.460	+ 9.759
Southport	225	226	214	204	206	208	186	193	49	14.586	− 710
Swansea	821	826	907	748	837	894	851	838	49	45.815	+ 3.224
Taunton	40	38	40	37	38	38	38	44	49	2.174	− 115
Tynemouth	149	160	144	136	142	133	141	138	49	11.820	− 798
Weston-super-Mare	29	31	28	24	30	27	26	26	49	7.056	− 379
Worcester	232	227	222	221	231	228	232	243	49	13.976	− 126
Wrexham and District	87	101	91	94	89	90	90	89	49	5.062	− 91
Yorks. (Woollen) District	877	906	834	830	836	832	834	842	49	45.969	+ 789
Burnley Corporation	1.108	1.181	1.090	1.154	1.127	1.180	1.253	1.187	24	30.568	+ 1.428
Burton-on-Trent Corporation	255	254	269	250	237	240	246	255	37	10.685	− 518
Bury Corporation	906	888	913	...	1.096	1.042	1.034	...	-	—	-
Cardiff Corporation	1.907	1.870	1.893	1.881	1.947	1.947	2.026	2.031	37	80.416	+ 2.450
Carlisle, City of	152	163	162	144	153	153	161	167	50	8.725	− 521
Chatham and District	604	644	621	591	605	599	619	631	50	35.756	+ 1.308
Chesterfield Corporation	208	199	189	188	213	213	208	210	38	8.434	+ 452
Colne and Trawden	186	197	181	178	185	186	187	185	--	—	--
Cork Electric	396	428	417	400	396	389	382	393	50	23.034	− 886
Croydon Corporation	1.257	1.274	1.276	1.181	1.248	1.224	1.282	1.275	37	52.997	− 1.908
Darlington Corporation	213	195	196	183	217	211	201	198	37	7.920	− 4
Derby Corporation	709	690	700	648	677	729	771	779	37	28.793	− 2.035
Dover Corporation	183	183	178	170	158	165	170	170	37	8.697	− 1.121
Dublin and Lucan	92	100	93	93	89	88	89	87	24	3.199	+ 216
Dublin United	4.591	4.770	4.662	4.617	4.675	4.704	4.717	4.777	24	157.414	+ 31.079
Dundee City	1.014	1.052	1.069	1.000	1.095	1.090	1.098	1.071	30	34.559	+ 1.041
East Ham Corporation	785	782	771	754	799	829	839	837	37	33.891	+ 108
Edinburgh and District	4.614	4.598	4.541	4.244	4.687	4.534	4.612	4.525	50	247.495	+ 2.004
Exeter Corporation	258	256	251	243	234	232	239	252	37	11.760	+ 567
Falkirk and District	...	...	...	...	264	264	278	254	-	—	--
Glasgow Corporation	16.422	16.776	16.298	15.932	17.094	16.296	16.858	16.850	28	495.252	+ 14.276
Glossop (Urban Elec. Supply Co.)	133	132	124	122	120	121	123	118	50	6.705	− 66
Hastings and District	...	...	...	...	710	743	740	736	—	—	-
Huddersfield Corporation	1.475	1.649	1.395	1.377	1.474	1.486	1.530	1.440	37	59.468	+ 2.669
Hull Corporation	2.318	2.307	2.327	2.226	2.459	2.603	2.496	2.466	37	91.316	+ 5.095
Ilford Corporation	403	410	408	385	379	387	453	381	37	17.325	− 729
Ilkeston Corporation	120	119	114	109	129	122	127	125	38	5.486	+ 327
Ipswich Corporation	321	327	354	304	307	312	357	309	37	15.321	+ 1.109
Isle of Thanet	222	225	225	217	256	233	240	216	50	31.651	− 235
Keighley Corporation	137	151	145	136	139	157	140	142	24	3.942	+ 245
Kilmarnock Corporation	141	148	148	142	146	142	145	142	30	4.855	− 110
Lanarkshire	845	875	845	830	1.209	1.208	1.240	1.179	50	60.201	+ 15.995
Lancashire United	969	1.058	1.027	955	1.178	1.092	1.047	1.152	50	63.105	+ 14.082
Leeds City	5.959	6.136	5.957	5.830	5.977	6.089	6.213	6.250	37	243.268	+ 9.991
Leicester Corporation	2.067	2.084	2.042	2.013	2.024	2.101	2.044	2.128	—	—	—
Leith Corporation	473	469	461	439	450	451	478	460	30½	16.224	+ 48
Leyton U. D. Council	485	500	802	763	822	831	874	839	37	38.883	-
Liverpool Corporation	10.586	10.540	10.641	10.467	10.200	10.133	10.560	10.575	50	545.487	− 7.692
London County Council	25.616	25.956	25.650	25.241	29.544	29.644	30.357	30.298	37	1.161.535	+ 192.410
London General Omnibus	20.990	20.883	20.223	19.586	17.593	17.763	18.371	18.565	24	494.145	− 49.669
London Road Car	7.499	7.428	7.152	6.882	7.715	7.542	7.754	7.707	24	205.172	+ 18.222
London United	5.155	5.266	5.215	4.913	5.235	5.312	5.313	5.342	50	321.845	+ 13.712
Lowestoft Corporation	154	151	149	135	164	163	160	150	11	1.917	+ 4
Maidstone Corporation	...	...	...	...	161	139	149	132	37	4.873	−
Manchester Corporation	13.347	13.522	13.122	13.155	13.657	13.302	14.192	14.123	37	550.890	+ 37.782
Nelson Corporation	129	131	126	130	127	125	127	126	37½	5.441	− 29
Newcastle-on-Tyne Corporation	3.941	4.012	3.973	3.876	3.892	3.898	3.990	3.928	37	152.033	+ 589
Newport (Mon.) Corporation	582	603	566	549	611	596	622	609	37	25.683	+ 1.940
Northampton Corporation	360	354	370	360	375	377	368	405	37	16.165	− 413
Oldham Corporation	1.760	1.708	1.745	1.570	1.796	1.848	1.805	1.844	38	74.084	+ 4.825
Portsmouth Corporation	1.481	1.460	1.469	1.420	1.494	1.468	1.497	1.489	37	75.124	− 1.500
Preston Corporation	664	667	673	669	692	674	676	686	—	-	−
Provincial	1.356	1.362	1.324	1.308	1.370	1.351	1.387	1.373	11	16.124	+ 665
Reading Corporation	578	585	556	556	553	560	567	594	36½	23.622	− 750
Rochdale Corporation	...	962	903	...	...	1.008	1.028	...	—	-	
Rossendale Valley	190	207	183	185	197	184	197	198	24	4.829	− 58
Rotherham Corporation	477	501	497	472	584	558	573	577	36½	22.367	+ 3.647
Salford Corporation	4.724	4.259	4.188	4.098	4.556	4.136	4.397	4.338	37	173.738	+ 4.730
Sheffield Corporation	5.351	5.322	5.340	5.192	5.347	5.510	5.425	5.507	38	211.999	+ 9.720
Southampton Corporation	854	875	862	796	935	915	956	932	36½	38.330	+ 1.971
Southend-on-Sea Corporation	252	257	244	246	264	252	261	265	37	15.736	− 17
South Shields Corporation	441	462	472	443	490	500	502	510	37	21.413	+ 4.887
Sunderland Corporation	1.290	1.250	1.266	1.193	1.137	1.182	1.122	1.208	37	51.612	− 1.119
Swindon Corporation	145	153	150	142	141	140	143	151	—	—	−
Tyneside Tramways and Tramroads	377	400	381	372	375	376	375	376	50	22.897	+ 919
Wallasey U. D. Council	755	733	765	742	712	692	744	747	37	31.583	+ 689
Walsall Corporation	502	522	517	489	531	538	522	537	50	26.076	+ 238
Walthamstow Corporation	425	427	587	382	477	481	450	467	37	22.927	+ 536
Warrington Corporation	362	...	...	352	361	...	...	373	35	14.070	+ 526
West Ham Corporation	2.030	2.118	2.126	2.034	2.074	2.087	2.175	2.177	37	85.924	+ 1.656
Wigan Corporation	1.119	1.150	1.170	1.117	1.204	1.225	1.180	1.284	37	46.729	+ 2.826
Wolverhampton Corporation	797	807	786	830	772	768	805	788	37	35.196	+ 170
Yorkshire (West Riding)	1.061	1.058	996	866	999	1.050	1.083	1.022	50	57.946	+ 14.791
FOREIGN TRAMWAYS.											
Anglo Argentine	16.817	17.307	17.814	17.385	18.142	18.751	19.632	18.980	50	845.499	+ 79.605
Calcutta Rs.	50.520	49.741	51.477	51.432	51.510	47.986	48.556	48.206	24	1.145.200	+ 44.269
Havana $	...	30.780	...	...	...	32.765	...	...	-	-	
Kalgoorlie (month)	...	3.728	...	...	...	3.790	...	...	48	43.715	2.946
Lisbon (month) Ms.	...	117.508	...	...	...	118.383	...	...	—		
Madras Rs.	(2 weeks) 13.967	(2 weeks) 15.021	...		(2 weeks) 16.203	(2 weeks) 18.348	...		50	396.465	+ 65.810
Perth (W.A.)	1.396	1.439	1.713	1.754	1.347	1.360	1.410	1.412	50	70.054	− 2.676
Singapore $	9.461	8.447	8.592	8.288	8.967	8.438	9.005	8.485	-	—	
ELECTRIC RAILWAYS.											
Baker Street and Waterloo	2.055	2.020	2.075	2.230	2.795	2.890	2.875	3.105	24	60.045	+ 20.830
Central London	6.825	6.666	6.749	7.096	5.901	5.931	6.006	6.173	24	126.547	− 19.279
Charing X Euston & Hampstead	...	...	...	...	2.865	2.915	2.900	2.950	24	63.625	
City and South London	2.914	3.016	2.943	3.370	3.325	3.559	3.222	3.656	24	75.338	+ 10.303
Great Northern and City	1.874	1.895	1.910	1.973	1.826	1.873	1.884	1.869	24	40.515	− 917
Gt. North'rn, Piccadilly, & Brompton	...	...	...	...	4.885	4.930	5.000	5.225	24	103.020	-
Liverpool Overhead	1.402	1.386	1.318	1.341	1.395	1.326	1.341	1.344	24	37.144	+ 1.743
Mersey	1.709	1.902	1.781	1.787	1.820	2.050	1.869	1.893	24	44.328	+ 3.037
Metropolitan	15.571	15.327	15.725	16.166	15.627	15.436	15.863	16.404	24	363.108	+ 6.504
Metropolitan District	8.682	8.157	8.221	8.372	8.228	8.513	8.580	8.678	24	186.841	+ 636

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That The Electric Construction Co. still maintains its reputation, is proved by the number of recent E.C.C. installations, which include the London County Council station at Greenwich—plant of over 18,000 Kw. capacity—The Great Western Ry. Electricity station at Park Royal—plant of over 7,000 Kw. capacity—and many other important modern Stations in EUROPE, AFRICA, INDIA, NEW ZEALAND, CHINA and JAPAN.

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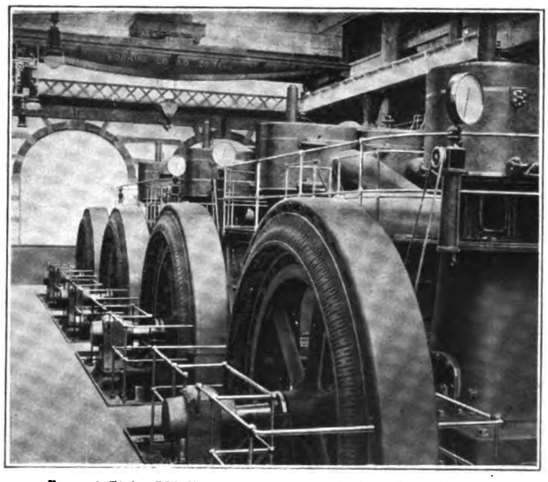

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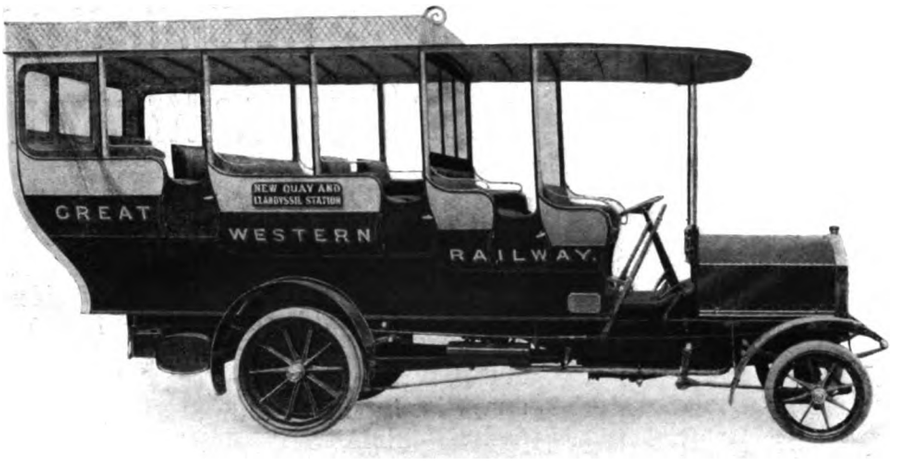

28 H.P. Char-a-Banc to seat 25.

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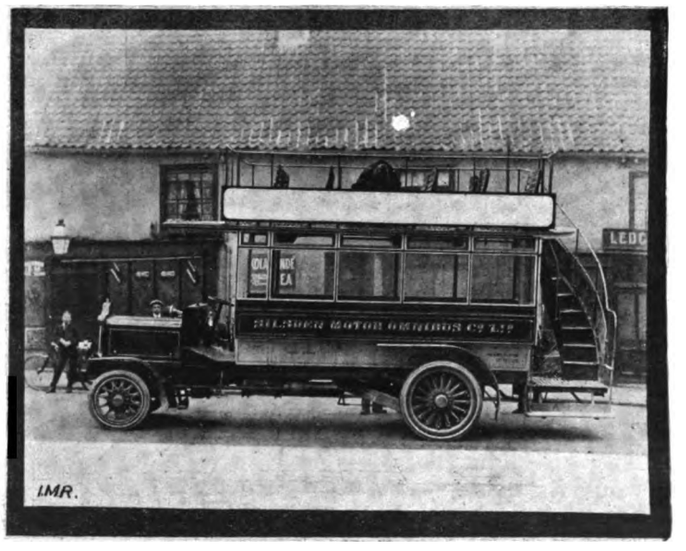
AN OPINION "AFTER 16 MONTHS' CONTINUOUS RUNNING."

SILSDEN MOTOR OMNIBUS CO., LTD.,
nr. Keighley, Yorks., Nov. 13, 1907.

Dear Sirs,

With reference to the Motor Omnibus which you supplied to us in July, 1906, after 16 months' continuous running we are pleased to report to you that the good opinion we at first formed of your 'Bus has been more than justified by results, **and we congratulate ourselves in owning what we consider to be the best 'Bus on the market.** In consumption of Petrol and Oil she is remarkably economical. As to repairs your ledger will disclose that **our purchase of parts, &c., from you during the last six months have not exceeded £5,** which fact speaks volumes for the excellent workmanship of your Chassis. She requires a minimum amount of attention to keep her at concert pitch, and we can always depend on her carrying her complement of passengers (40) with ease up the long and steep gradients so numerous in this locality. We have nothing but unstinted praise for the manner in which your 'Bus has done its work on our country roads since July, 1906.—Yours faithfully,

p. pro **Silsden Motor Omnibus Co., Ltd.**
(Signed) M. P. CRYER, Secretary.



THE 'BUS REFERRED TO ABOVE.

RYKNIELD
MOTOR CO., LTD.,
BURTON-ON-TRENT.

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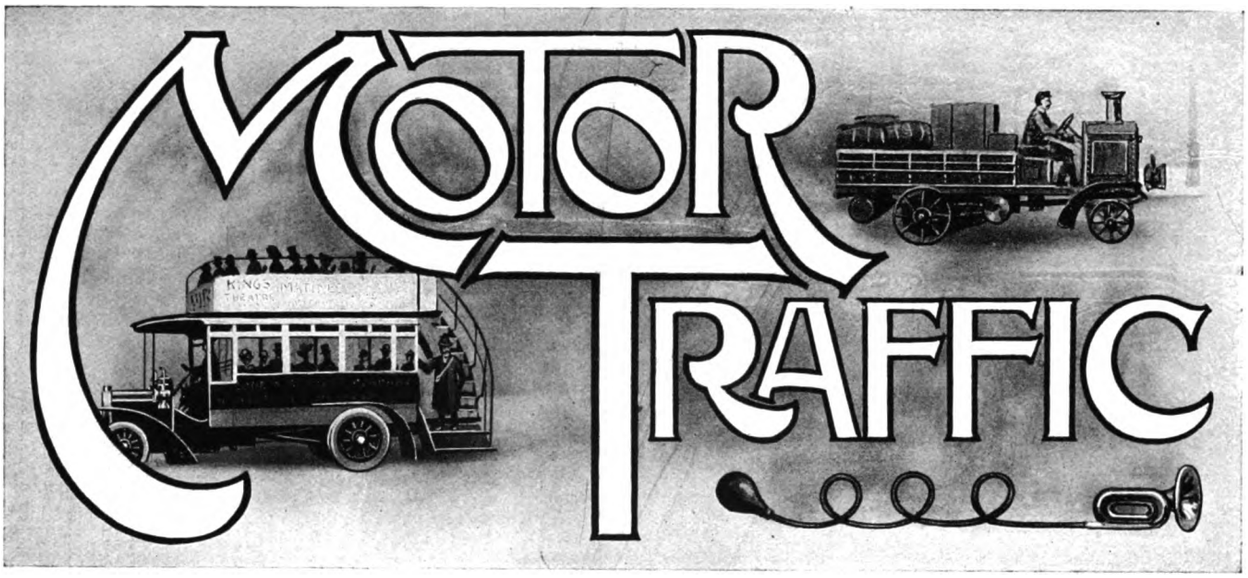

The speed and distance recorder, which is described and illustrated in our present issue, is a piece of mechanism which ought to be of special value to motor omnibus companies. Hitherto it has not been on the market, but the arrangements for manufacturing it are, we believe, now practically completed. The instrument has been thoroughly tested, and while it will probably prove very useful to railway companies, we can hardly think it will be of more value anywhere than in connection with motor 'buses. Among the matters on which the manager of a motor 'bus company ought to be fully and regularly informed are the speeds at which the 'buses are driven, the aggregate length of time occupied by stops, and the total distance run per day by every 'bus. The manager ought to know that the proper speed in every case is as far as possible maintained and—what is quite as important—that it is not exceeded. If the speed is too low, passengers are discouraged; if it is too high, the mechanism of the 'bus is before long shaken to pieces. There should also be a check on the number and duration of the stops.

As to the distance run per 'bus per day, unless this is absolutely known it is impossible to get out exact figures of revenue and expenditure per mile run. If every 'bus belonging to a company always runs over a given route, the length of which has been accurately measured, tolerably accurate figures can be got. But it is one of the advantages of the 'bus that it can be taken off its regular route and put on to any service required, over either town streets or more or less unknown country roads. Then distances have to be taken on trust, or estimates made. All these difficulties can be overcome by the use of the recorder, which provides a permanent record traced on paper of the speed of the vehicle at every point of its journey, of every stop and its duration, and of the total distance run. The instrument is a most ingenious one, and ought to pay for itself in the long-run.

The paper by Mr. Hardy, resident engineer of the Bath Electric Tramways Company, on the management and working of a motor 'bus undertaking is calculated to be of great value to all who have entered the motor omnibus business. While it will prove most helpful to managers and engineers of smaller undertakings and to those who contemplate starting motor 'bus services, it is probable that some of the officials of the larger companies in London also may be able to gain some benefit from a study of the paper. It is not so long since want of success in some quarters in the metropolis was ascribed to want of knowledge on the part of those responsible for the operation of the vehicles. Mr. Hardy was able to bring to bear on the subject his knowledge of methods of operation not only of a tramway system employing a considerable number of cars but also of a motor 'bus service belonging to the same company. The careful organisation and method both from the engineer's and the manager's points of view, the attention to detail, the system of accounting, and the probable financial results —all these were well set out in the paper. We are glad to observe that Mr. Hardy is not too optimistic as to the profits to be made. His figures as to working expenses coincide almost exactly with those which were put forward in these pages at the time when the motor 'bus became a practical vehicle. If the advice given by Mr. Hardy is followed, we may speedily see quite a number of small and moderate-sized financially successful motor 'bus undertakings in existence in various parts of England.

The motor cab business in the provinces is now in the same position as that connected with motor omnibuses in London was a year or two ago. New motor cab companies are being formed in different parts of the country and great expectations are entertained. In London two or three motor cab companies have got to work, and the directors' report and the meeting of the General Motor Cab Company are of an encouraging nature. It is necessary, however, to warn investors in cab companies both in London and the country that the results to be obtained a few years hence may not be so good as those in the earlier days. When a limited number of new motor cabs have only to compete against horse cabs, the former are certain to be fully employed. When the number of motor cabs has so increased that they compete strongly with one another the takings per cab per day are likely to fall off somewhat. At the same time, the cost of repairs will go on increasing as the cabs grow older. We gave the same warning in the first days of the motor 'bus, and the event has justified our view. In regard to both types of vehicles, permanent success can only be achieved by moderate capitalisation, and good engineering, financial and commercial management, and the piling up of a large depreciation fund. From the nature of the service, however, we anticipate that the machinery of the motor cab will have a longer life than that of the motor 'bus.

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MOTOR TRAFFIC.

STONE'S RECORDER FOR AUTOMOBILES.

Messrs. J. Stone & Company, Limited, Oceanic House, Cockspur Street, S.W., whose works are at Deptford, are bringing out a recorder for railways, and for automobile and other vehicles. This little apparatus is of simple and solid construction, is moderate in price, and can be adapted to chronicle all the movements of any vehicle to which it may be fixed, whether a locomotive engine or any other carriage, wagon, or van in a train, whether tram or motor car, 'bus, lorry, or delivery van, and whatever be the motive power—manual,

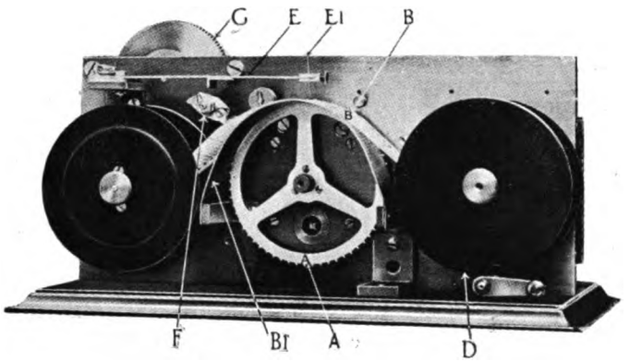

Fig. 1.

animal, steam, gas, or electricity. Moreover, the recorder can be connected to any wheel of a vehicle or train; and as it is actuated by a roller pressing on the tread or outer diameter of the wheel, the distance gone over is registered independently of the diameter or wear of the wheel from which it derives its mileage records. In other words, it works as if the roller were running on the rail or road, while there is no danger of its being damaged in passing over points and crossings or other obstacles. Continuous records can be kept up for eight days on one roll, and they are made by perforations on a stout tape, being thus indelible and almost indestructible.

perforations the needle jumps instantaneously to the top of the tape and starts another transit. It follows that the greater the speed the less the horizontal distance between the dots and the more vertical the transverse line. When the vehicle is going forward the dots slope downwards, when it is at rest they cease, and when it goes backwards the dots slope upwards, the tape moving on at a uniform rate all the time. The parallel transverse arcs on this tape represent half-minutes of time, the hours and five-minutes' intervals being printed on the lower margin. Taking the number of intervals between the dots in every half-minute, and multiplying by $\frac{10}{3}$, give the miles per hour.

It is evident that every speed, every retardation or acceleration, and every stoppage is most accurately delineated. The value of this information to users of vehicles of every description would, in many cases, be enormous, and in every case would be interesting. Moreover, in cases of dispute, in cases of accident, the testimony of this record could not be impugned, and would be absolutely reliable. The causes of many abnormal events would often be determined, and those of them which are now puzzles to all concerned would be explained to everybody's satisfaction. The time and distance record being simultaneous, any overrunning of signals or excess of speed on any particular part of the journey would leave its indelible mark on the instrument, as the record cannot be tampered with or altered without detection.

Fig. 1 is a front elevation, and Fig. 2 a plan of the apparatus, the lettering being the same on both. A clock movement is contained in a dust-proof case, and rotates the pin-wheel A at the rate of one revolution an hour. The pins on the wheel A engage the marginal notches on the tape B (these are represented by the little circles all along the top edge of the tape) and pass it along over the platform B^1 to the receiving-reel D. A spring-arm E, pivoted near one end, is fitted with the perforating needle E^1 at the free end; this needle can be adjusted. The arm E^2 at the pivoted end of E, bears a cam E^3, of such a shape that the rotation of this cam causes the needle E^1, at the free end of E, to traverse the tape, the normal vertical position of the needle being slightly above the tape B.

Below the spring-arm E is a revolving tappet F, which raises the arm at uniform intervals of distance, releasing it suddenly and causing it to deliver a perforation on the tape, and to instantly recoil to its normal position clear of the tape. The cam E^3 and the tappet F are mechanically connected with each other and with the wheel or axle of

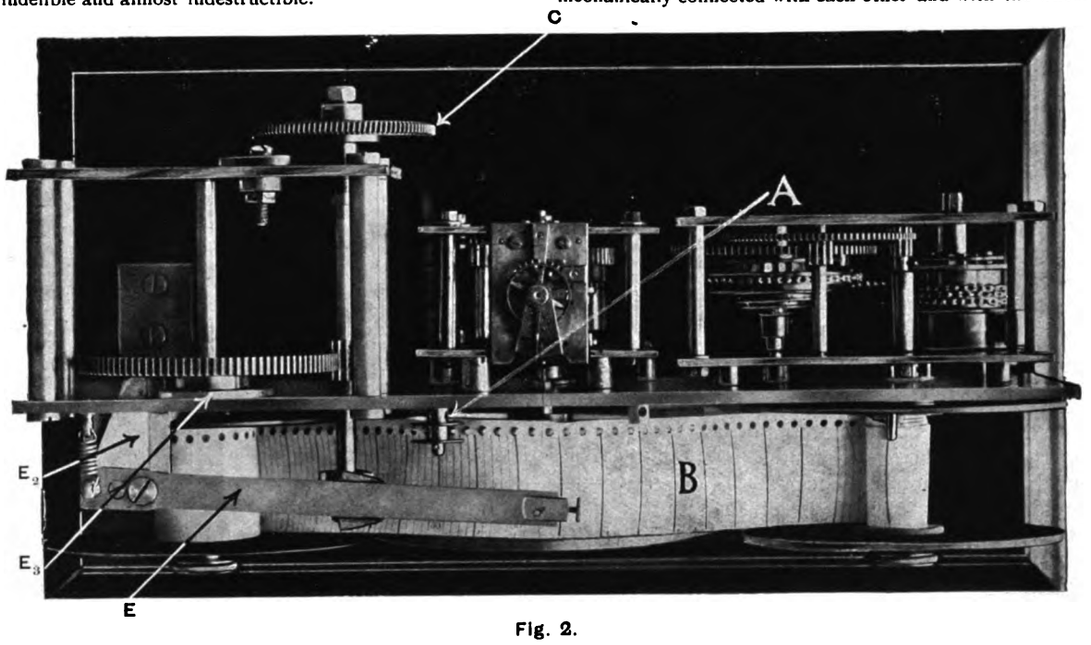

Fig. 2.

The machine shown in the illustrations is a "standard" one, as used in the record of an eight days' working on a motor car. Of this one day's work is reproduced and proves how minutely every movement of the vehicle is chronicled. All the dots shown on the record (which has been cut up in lengths for ease of reproduction) are perforations, and the text below the lengths fully explains the meaning of the dots, which, indeed, almost explain themselves. The tape is graduated to half-minutes of time, and is constantly moving under the action of a clock. The needle which makes the record moves transversely across the tape twice in every mile, and makes eighteen perforations during its transit. The distance between each perforation, therefore, represents 1-36th of a mile, or just under 49 yards. After each eighteen

the vehicle, so that as it moves the spring-arm makes a transverse line of perforations across the tape, each perforation, as already explained, representing a given unit of distance, and each complete line of perforations a certain uniform distance. On completing a line the shape of the cam causes the spring-arm to instantaneously return to the other side of the tape before making the next perforation at the commencement of a fresh line. The mechanism works equally well in either direction of motion, the only difference being that in reverse movement the needle crosses the tape while perforating its lines in the opposite direction to that in the forward movement. The record reproduced being taken from a motor car, the amount of reverse motion was not sufficient to leave any record.

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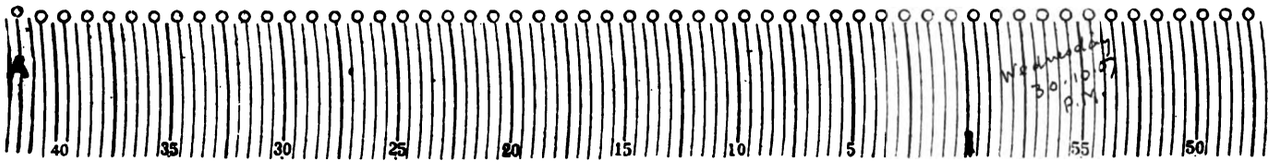
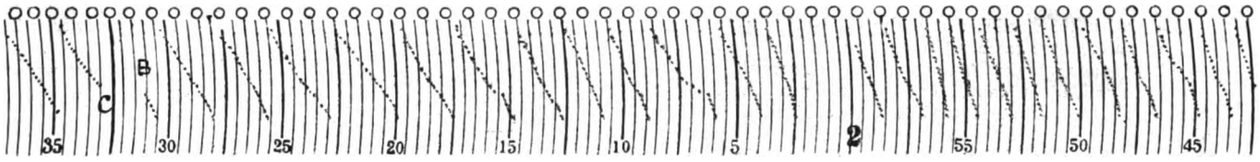
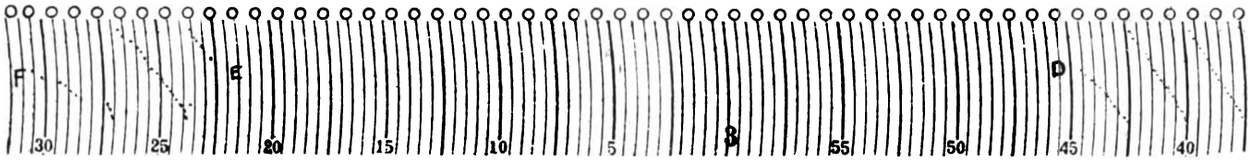
MOTOR TRAFFIC.

Controversy Regarding the Motor Car Record between the Inventor and the Owner Regarding a Record which Overstated the Direct Distance between Surbiton and the Owner's Office.



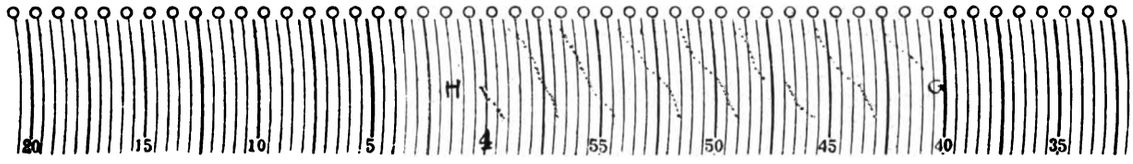


"According to the record, the car started from Surbiton at 1-42½ p.m. (A); would this be about the time?" "Yes, it would be about that time." "Did it come straight up to your office?" "Yes." "Then there is a stoppage recorded here (B) exactly 12 miles from Surbiton. But if this is where it reached the office, you must have been waiting for it at the door, as the stoppage is one of 2 minutes only (B-C)?" "No, that was not the case. I did not leave office for some time after the arrival of the car was

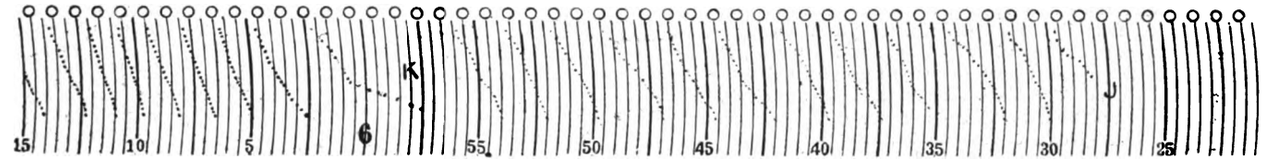


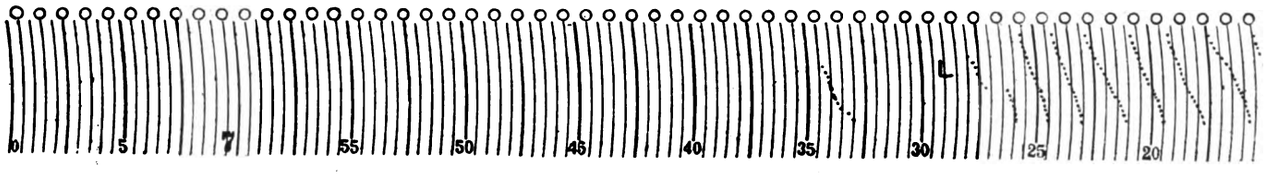
announced." "How long did you keep it waiting?" "About half-an hour, I should say." "Then this next stoppage of 38 minutes (D-E) is obviously when it was waiting at your office. But in that case it must have arrived there at D, which is a little over 14 miles from Surbiton. Are you sure it came direct? There are one or two short stoppages on the way which might indicate errands?" "I gave the chauffeur no errands, and there is no reason why he should have come by any indirect route. He may have gone off on some errand while waiting for me, which would account for the extra 2 miles (C-D)." "No, that would not account for it. These 2 miles (C-D) were done without stopping. If he went on an errand, it must have been performed at the end of the two miles (D); and in that case another run of about the same length must have appeared after (D), by which he got back to the office again. From a mechanical point of view, can you think of any way in which the instrument could over-record the mileage?" (After consulting his pocket book) "I have it! I find that the instructions I left were to drive first to my club, and, if I was not there, to come on to the office." "What, the Oriental Club, Hanover Square?" "Then that agrees exactly with the record. Hanover Square is just about 2 miles from your office, is it not?" "Yes, I should say so." (A reference to the map will show that neither Hanover Square nor the office is on the direct route from Surbiton to the other, but that they are about equidistant. In the diagram, B– which is 12 miles from Surbiton—is clearly where the car reached the club, the following 2 miles (C-D) being the run from the club to the office.) "Did you leave office at about 20 or 25 minutes past 3 (E)?" "Yes, about that time." "Where did you go then?" "Back to Surbiton." "This does not look like a run to Surbiton. At a little less than a mile from the office (E-F) there is a stoppage of 11 minutes recorded (F-G). Do you remember anything about this?" "Ah, yes. I went first to the Stores." "What, the

*4-21 p.m. to 5-21 p.m. is omitted, being blank.



Army and Navy Stores, Victoria Street, about 1 mile from your office?" "Yes." (This again entirely agreed with the record.) "After leaving the Stores, where did you go?" "Home to Surbiton, as far as I remember." "But the distance is much too great for that. It is about 17 miles (G to L). Besides, there is a long stoppage of nearly an hour and a half (H-J)* about 3½ miles (G-H) from the Stores?" "Oh! Yes. Now I come to think of it, I took a friend to Ladbrooke Grove." Ladbrooke Grove is about this distance (G-H) from the Army and Navy Stores. It is not on the route to Surbiton, but lies roughly on a circle passing through Hanover Square and your office with Surbiton as centre; so it would be about equidistant with these places, though somewhat nearer to Surbiton if anything. (For





the third time the record proved right.) "What was the next place you went to?" "I am quite certain I went home this time." "This leaves 13½ miles. There is still an extra 1½ miles, at least, to be accounted for (J to L), as Ladbrooke Grove is if anything rather nearer to Surbiton than to your office. Can you account for it, as the record has so far proved itself very correct?" "No. I cannot think of anything to account for it." (On noticing the very conspicuous irregularity in the diagram at K) "Do you remember any bad block of traffic to account for the car crawling for a considerable distance about 6 miles from Ladbrooke Grove?" "Yes; at Putney. It was not traffic. We found the road up, and in a dreadful mess. We had to go ever so far round to get out of it." "Then that would account for the extra mileage. About how far had you to go round? Would it be as much as a mile and a half?" "Yes; fully. We had to go right round by Putney Bridge."

Thus the record proved to be correct throughout, and served to bring to light incidents of which the inventor knew nothing and which the owner had quite forgotten. This is a specially interesting instance of how it might afford valuable evidence.

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MOTOR TRAFFIC.

The reel D is made up of a wooden core and two separable discs of wood or metal, which form deep flanges. This composite reel fits on the spindle of an independent piece of clock mechanism, and can be rigidly clamped on to the spindle by a milled nut. By removing the outer disc access is gained to the wooden core on which the tape is coiled. When the disc is replaced, and the clockwork is released by a catch, a light rotary pressure is exerted on the reel, tending to coil the tape neatly as it passes off the tape-plate, after receiving its record. This clockwork will coil an eight-day tape without attention, and exerts an even tension on the tape in spite of the increasing diameter of the coil. The time-keeping properties of the clock are thus preserved, as it is entirely relieved of the work of driving the tape.

The only part of the reel which has to be removed when a fresh tape has to be started is the wooden core with the record wound round it. A fresh core between the same two discs as before forms an empty reel for further records. The core, with the record on it, can be filed, and, when wanted, can be fixed on a simple appliance which enables the record to be examined conveniently.

The pin-wheel system of feeding the tape renders the time-accuracy of the machine quite independent of the expansion and contraction of the strip; this does not move at the rate of so many inches an hour, but of so many pin-holes or time-arcs per hour, irrespective of the condition of the tape.

No ink or pencil style can smudge the record. The needle can easily be renewed, but seldom requires to be changed. The instantaneous action of the needle precludes any danger of tearing the tape, and, finally, an immense amount of detail can be condensed into a compact diagram. By breaking this up into short sections, and placing them transversely, the width of the tape is utilised, and space is economised without crowding, in very much the same way as when soldiers are drawn up in columns of companies instead of in line.

It is evident that the apparatus may be adapted to any scale of time or distance recording. It can be locked up so as to be inaccessible to anyone not possessing the key, and at the same time it can be placed in sight of the driver, who will then be able to see at any moment the speed at which he is going, and the time he has been on the road. Any given velocity could be printed in sloping lines on the tape, and the driver could see at a glance if he was exceeding such fixed speed.

The machine used on the auto-car record reproduced was one designed for a locomotive engine running up to 80 miles per hour. A much lighter and simpler machine is being made for use on road vehicles, which will be very much cheaper, as it will not be necessary to register backward motion.

Should this machine come into general use it would not be necessary to have any speed restrictions whatever, and drivers would take every care not to drive to the common danger. The distance and time being both indelibly recorded would show whether he was goiug moderately fast at any time or place—that is, during fog and through congested traffic.

The standard recorder we have described is suitable for ordinary railway running up to a speed of 80 M.P.H. Should more minute detail be required the gearing can be varied according to such requirements, consistently with the maximum speed of the vehicle. The gear-wheel C can be so disposed, for instance, as to give only three or four lines of perforations per mile. By loosening the nut at the end of the spindle the pin-wheel A can be rotated so as to set the tape to the actual time of day, and the machine then becomes a recording clock. The apparatus has been working on motor cars for some time past, and has given every satisfaction.

ARGYLL CABS FOR LONDON.—At the annual meeting of Argyll Motors, Limited, in Glasgow, the chairman stated that the company had received an order for motor cabs for London to the value of £20,000. If the sample cabs came up to expectation the order would be increased to £80,000.

"STIRLING" MOTORS ABROAD.—As evidence that Mr. John Stirling, managing director of the Scott-Stirling Motor Company, Limited, of Twickenham and London, is fully alive to the importance of the export trade, it is interesting to learn that "Stirling" productions are already in use in the following countries: The Argentine Republic, British Guiana, India, South Africa, Australia, New Zealand, Canada, Norway, Holland, Spain, Italy, and Egypt. The Scott-Stirling Motor Company are, we understand, arranging for further developments in their foreign business in wagons using either petrol or paraffin fuel.

THE MANAGEMENT, ORGANISATION, AND WORKING COST OF A PUBLIC-SERVICE GARAGE.*

BY W. E. HARDY, A.M.I.E.E.

When invited by the Secretary, on behalf of the Council of the Society of Road Traction Engineers, to read a paper under the above title, I felt very diffident about accepting the invitation, for the reason that I have only had a limited experience with a comparatively small number of mechanically-propelled vehicles, having been more directly concerned with those that are driven by electric power. The

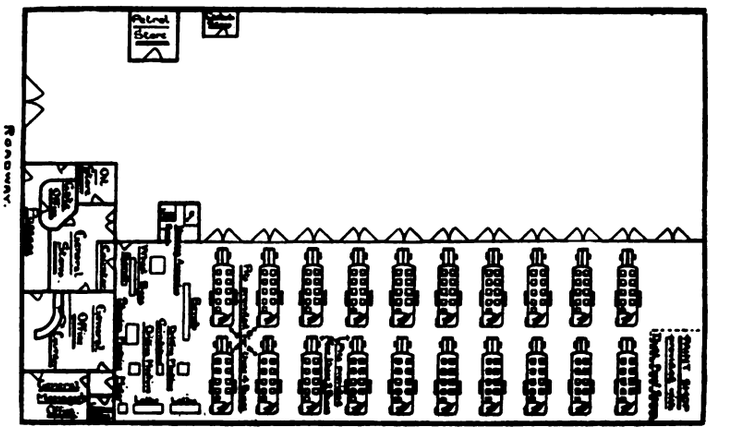

Fig. 1.

Secretary of the Society, however, said that the Council felt that the immediate developments of public services for motors would tend, outside London, to a small rather than a large number of vehicles per undertaking, and that view, therefore, must be my excuse for bringing this paper before the Society.

At the outset, I may say that my remarks more particularly apply to the petrol-driven vehicle, rather than to those driven electrically or by steam, as by far the greater number of 'buses, lorries, vans, etc., use petrol as the fuel.

In order the more easily to discuss "The Management Organisation and Working Cost of a Public-service Garage," I shall take a concrete case of a system having 20 vehicles, and first proceed to investigate the arrangements that are made for garaging, repairing, petrolling, etc.

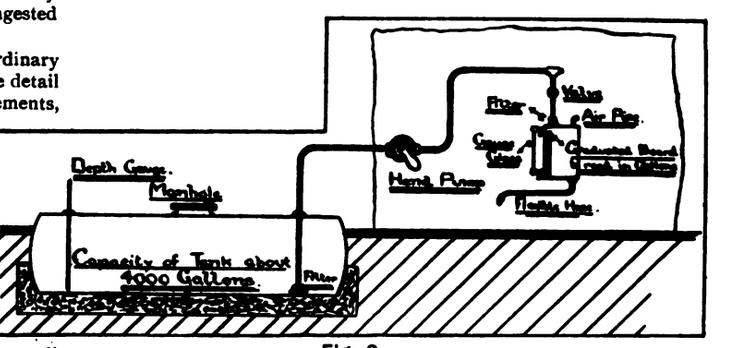

Fig. 2.

GENERAL ARRANGEMENTS.

The capital cost of a commercial motor vehicle undertaking can almost be regarded as a small matter compared with the ultimate cost of operating, and this fact is more fully emphasised when the relative advantages of electric cars and motor omnibuses are being considered. While the electric car, with its power-house, cables and permanent way, may, in the first instance, cost four or five times as much as a motor 'bus installation, yet the operating costs are so decidedly in favour of an electric car, that in populated districts the electric car can, generally speaking, more than hold its own. A garage should be laid down, therefore, with the ultimate end of efficient and economical

* Paper read before the Society of Road Traction Engineers, December 10, 1907.

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MOTOR TRAFFIC.

working, rather than the immediate saving of a few pounds in initial expenditnre.

There are, no doubt, many other possible arrangements that could be made for a garage, but I think the plan I have shown in Fig. 1 will be found to be as convenient as any. In this case, the vehicles are placed ten abreast in rows of two, with sufficient yard space to enable them easily to turn in and out of the shed. The effect of this arrangement is to reduce the moving of the vehicles to a minimum, as, at the most, only one vehicle has to be moved to get any other out of the shed. This is an important feature, in view of the fact that for many reasons

Form 1.

TOOL SHEET.

....190....

I hereby agree that I have taken over or returned with the bus in accordance with the position of my signature, all the following tools in good order:

TOOLS.

1 Axle spanner.	1 Flat chisel.
2 Tank spanners.	1 Screwdriver.
5 Spanners, $\frac{1}{4}$", $\frac{5}{16}$", $\frac{3}{8}$", $\frac{7}{16}$", $\frac{1}{2}$", $\frac{5}{8}$", $\frac{3}{4}$", $\frac{7}{8}$", 1".	1 Pin drift.
	1 Piece copper binding wire.
1 Box spanner for sparking-plugs.	2 Oilcans (feeders).
	$\frac{1}{2}$ gal. Oilcan.
1 Cycle spanner.	1 Fire extinguisher.
1 Hammer.	3 Cartridge generators.
1 File and handle.	1 Water can.
1 Pair flat pliers.	1 Tripod spanner.
1 Pair gas pliers.	1 Tin grease.

SPARES.

2 Spare sparking-plugs complete with joints and holders.	1 Governor spring.
2 Sparking-plug springs.	1 Inlet or exhaust valve spring.

Bus No.	Signature of Driver taking bus out.	Signature of Driver returning bus.	Remarks.
No. 1			
No. 2			
No. 3			
No. 4 and so on			

it is not possible to arrange the vehicles in the shed at night in the order that they should go out on the following day, and much time and expense may thereby be saved.

The workshop is shown situated next to the office, and near the entrance to the garage, and is equipped with a suitable outfit of tools to enable the repairs to be carried out cheaply and expeditiously. In the diagram which I have prepared, two lathes are shown, one small drilling machine, a shaping machine, a grinder, blacksmith's forge, and a wheel press for re-tyring. Pits are provided in the shed, under the four vehicles next to the workshop, for facilities in repairing and overhauling, and also under the third and fourth row for the purpose of re-blocking the brakes, etc., of the service vehicles, in case all the other pits are occupied by vehicles under repair. At the end of the shed is left a space that can be enclosed for the purpose of painting and revarnishing the bodies.

The offices are situated next the road, and adjoining the workshop. The gate office is occupied by the time-keeper and store-keeper, as, being only a small system, the time-keeping and store-keeping can be attended to by one man. The oil stores are kept separate from the general stores, and workmen coming for different articles are served at the counter. The gate office has glass windows, so that the timekeeper can see people coming in any direction. Next to the general stores is the enquiry and general office, with doors communicating with the stores and the engineer and manager's office. Centralisation of the offices, stores and workshop, means a considerable saving in time by affording facilities for direct and personal communication. Thus, the engineer can at once enter the works or general office, whilst the clerks have immediate entrance to the stores, time office and shop. The foreman's office is between the workshop and the manager's office.

Near the gate to the shed, on the left-hand side going in, are the petrol and filling tanks, placed clear away from the main building. The carbide store is just beyond the petrol store, and here all generators should be re-charged.

The procedure for the vehicles going in and out of garage is as follows: The night foreman should book up the vehicles, for the different routes or journeys for which they may be required, on a blackboard which is provided for that purpose, at the timekeeper's office. He should then see that all is ready on each vehicle for the driver to take over at reporting time; if one vehicle that is behind another has to go out first, then the front one should be run into the yard, so that there is a clear way out for the driver when he reports to take his 'bus. The driver should report some 20 minutes or so before the vehicle is scheduled out, and the conductor some five or ten minutes before. In the case of the conductor, the reporting time is allowed for receiving tickets, punch, running times, and getting destination boards for the particular route on which his 'bus is scheduled.

After the driver has booked on, he refers to the 'bus output board, and then goes to the 'bus indicated, tries the brakes, sees that the oil tanks are full, oils the engine, and generally satisfies himself that the vehicle is in good condition for the road. He also goes through the tools and small spare parts which are carried on the 'bus, and satisfies himself they are correct with the list as shown on a form which he has to sign before leaving the garage, and which makes him (or the driver who brings the 'bus home) responsible for their safe return. As tools, when handled by a number of men, are most evasive articles, and as it is absolutely necessary that a driver should be supplied with all necessary tools for remedying a small defect on the road, or to do any adjustments that may have to be made, a system of some sort should be enforced so that a driver does not have to delay his 'bus for want of a spanner to adjust the brakes, or the right implements for getting at the carburetter jet or changing a sparking plug. This is of great importance. Form 1 shows such a tool sheet, and on these the driver signs for the tools and spares that are carried on the 'bus, and also signs for them on bringing in the 'bus after the day's work. In the event of any tools being missing, the driver or drivers, as the case may be, are required to account for their absence.

The driver then starts his engine, and takes his 'bus out of garage at the scheduled time. On returning at night, the driver hands over his 'bus to one of the shed men, at the gate, after having put out his lights and, before booking off, signs the log sheet for the vehicle or vehicles that he has been driving during the day. The shed man then "petrols" the 'bus, examines the tools, and backs the vehicle into the shed, so that it is in its right position for running out of the shed on the following morning. Of course, if the brakes have to be re-blocked, it will probably be convenient to run it over a pit. It is not a bad plan for the man who examines the tools to seal up the tool locker on the 'bus with a lead seal, as it prevents the shed men from getting at these tools, and using them instead of their own.

PETROL STORAGE.

Probably the best method of storing this volatile spirit is in a large tank, buried in the ground; this should have an escape and a suitable indicator, the latter calibrated to read off the amount of petrol in the tank, according to the level. The petrol is then delivered, preferably

Form 2.

From 10 am ——— To 10 pm ———

Description		No. of Bus																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Petrol	Gals																					
Carbide	lbs																					
Cylinder oil	pts																					
Gear oil	pts																					
Gear Grease	lbs																					
Axle Grease	lbs																					
Paraffin	pts																					
Waste	lbs																					
Rags	lbs																					
Petrol Pulse	pts																					
Soap	pts																					

3 6.

Signed ———

by road tank wagon, which can be checked on a weighbridge for weight full and empty against the advice note of the supplier. By this means, all handling of barrels is avoided, as the petrol can be emptied direct into the storage tank. This method not only saves considerably in labour, but it also very much simplifies the records. As the petrol bill on motor vehicles is one of the principal items of the running cost, every means should be adopted for studying and obtaining economy in consumption. One essential feature is to know the amount of petrol consumed by each individual vehicle, and means should be provided to this end.

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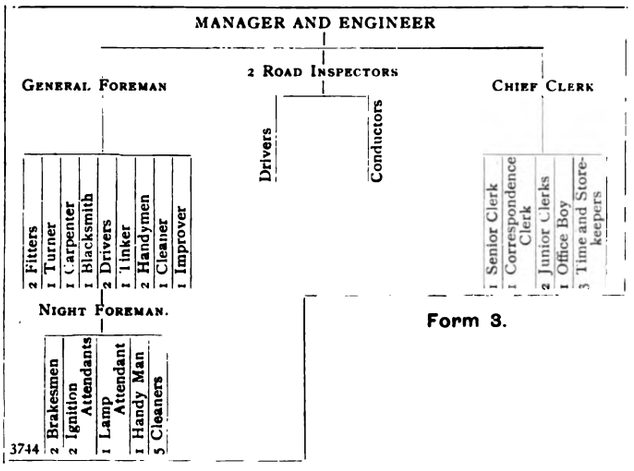
MOTOR TRAFFIC.

Fig. 2 is a diagram showing the petrol storage tank, with a pipe connecting, through a small semi-rotary pump, to a smaller tank, provided with a gauge glass, which is carefully calibrated in gallons. This small tank, which will hold about 40 to 50 gallons, is placed at such a height that the petrol will flow into the tanks of the vehicles by gravitation. The shed man who does the "petrolling" at night can read off, direct from the gauge glass, the "gallonage" that is taken by each vehicle. The tally is left with the night foreman, who enters same up on a quantity sheet (Form 2) together with the various lubricating oils and greases and sundry stores that are used for the daily



Form 3.

working. The petrol consumption can, therefore, be very carefully watched, and defects entailing high consumption remedied without delay. In many cases, the individual driver can be checked, but, in the case of 'bus services, it usually happens that more than one driver is on the same 'bus during the same day.

Petrol consumption is a matter of such vital interest, that I hope the discussion will bring forth information with regard to economy in this direction. Various and many carburetters, auxiliary air-valves, etc., have been tried, but nothing seems to have made that marked improvement for which many of us are waiting and anxiously looking. The Gillett-Lehmann controller, on some makes of machines, has certainly been helpful, but there still appears to be scope for ingenuity in the improvement of carburetters. The alarming report of the Motor Union Fuels Committee, with regard to a petrol famine, may give an impetus to manufacturers and inventors to produce a carburetter, not only for using less petrol but for adopting other fuels, which will have the effect of reducing the pence per 'bus-mile, and lessening the anxiety of the management concerning the dividend.

LUBRICATION.

One of the prominent representatives of the oil trade said to me, not long ago, that he regarded a contract for lubricating oil for one motor 'bus as almost as good as a contract for a power-station! Certainly, it must be a fact that a majority of oil used in motor engines is absolutely wasted. Of course, some engines are far more wasteful than others, but careful supervision, coupled with the longer experience of drivers, should have, and in fact already has had, the effect of greatly reducing the amount used. The present tendency of engineers is to use a cheaper oil, and in many instances they have found it to answer equally well; but, for any great economy, the driver is the man that must be looked after. In the case of those engines where the crank-chamber doors can easily be removed, the drivers should examine the level of the oil in the crank chambers several times during each day, while they are waiting at the various termini, in order to make sure they have the requisite amount of oil, though, here again, unless the cover is a very good fit, or else there is a good sound joint, these covers in themselves are a source of leakage. Apart from the monetary consideration, over-lubrication is both detrimental to the running of the engine, by oil getting on to the plugs, and causes smoke to proceed from the exhaust, while the excess oil drips all over the road. Naturally, this cannot be avoided altogether, but it has been, and I believe can still further be, reduced by paying the strictest attention to economy consistent with the proper lubrication of the working parts.

On some of the latest chassis models, automatic lubrication has been introduced, and it would be interesting to know, from those engineers who have had experience with these models, whether a more satisfactory result is obtained.

The amounts of oil, grease, etc., used on each vehicle per day are entered up on Form 2, together with the petrol.

PERCENTAGE OF 'BUSES ON ROAD.

Having considered the general arrangement of the garage, we will consider the staff necessary satisfactorily to keep the vehicles in running order. One of the most important questions that has to be first decided is, what average proportion of the vehicles it is advisable to keep out on the road in every-day service. It it very nice to be able to say one has 90 per cent. of the vehicles on the road; but is this the right policy? It is, no doubt, quite possible to keep a very high percentage on the road when the vehicles are new, but a day of reckoning will surely come, when this encouraging state of affairs will have to be paid for dearly in spare parts. In the example under consideration, namely 20 'buses, I am of opinion, if an average of 13 'buses are run per day, seven days a week, at an average of 90 miles per day, that this will be found, in the long run, to be the greatest number that can be kept on the road consistent with efficiency, where a regular service has to be run daily. This number would, however, allow two or three 'buses to be kept in readiness for changing over and for special service while the remaining five would be going through the hands of the day repair staff

I am aware that 13 is rather a small percentage to keep on the road, but I feel sure it would have the effect of providing the maximum

Form 4. DAILY LOG SHEET BUS No

ROUTE ..... TIME OUT ..... TIME IN ..... FROM 10 am ..... TO 10 am ..... 190 .....
ROUTE ..... TIME OUT ..... TIME IN .....

REPORT OF MOTORMAN							REPAIRS EXECUTED	BY WHOM	WORK DONE	BY WHOM
									Petrol Tank Filled	
									Oil Pumps and Oil Filled	
									Radiator & Water Tanks Filled	
									Differential Gear Case Oiled and Greased	
									Change Gear Case Oiled and Greased	
									Grease Cups Filled	
									Axle caps Oiled & Greased	
									Cardan Shaft Joints Greased	
									Rack and Pinions Greased	
									Accumulators charged and lamps Trimmed	
									Bus Cleaned	
TYRES	FRONT		BACK						Ignition Plugs Examined	
	LEFT	RIGHT	In	Out	In	Out			Ignition Overhauled	
Present No										
No changed from										
Where Taken from										
Time off							Signature of Motorman		Brakes Adjusted { Hand, Foot, Wheel }	
Time on										
3745.										

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MOTOR TRAFFIC.

number of 'buses for service on holidays, and those days when the revenue per car mile is worth looking after, as in nearly all districts there are certain days and seasons of the year that have an important effect on the receipts of an undertaking whose business it is to run motor vehicles. With motor vans, it is probable that the average percentage can be increased, but, even in this case, I think it is a mistake to try and attain a very high percentage. Motor vehicles must, and will, have great attention paid to them at the hands of thoroughly efficient men, and, unless this is done, expensive breakages will occur, which otherwise might have been prevented.

On Form 3 is a table of staff which appears to me would be necessary, but it does not include the secretarial department. Directly under the manager and engineer, on the engineering side, is the general foreman, who has control of all the shop and shed work, and to whom the night foreman is directly responsible.

DAY DUTIES.

The day men are chiefly engaged on repairing, overhauling, and making examinations of the working parts. The drivers' log-sheet reports, which are made when the vehicles come into the garage at night, are carefully gone through by the night foreman, and any

FORM 5

PAGE 4.

Bus No.	Petrol in Gallons	Mileage	Miles per Gallon.	Remarks
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
	3747			

PAGE 1.

COST CARD

FOR WEEK ENDING.....

Receipts	Current Week £.	s.	d.	Weather	Corresponding Week Last Year £.	s.	d.	Weather.
Thursday								
Friday								
Saturday								
Sunday								
Monday								
Tuesday								
Wednesday								
Total for Week				Per Mile				Per Mile
Route A								
" B								
" C								
" D								
" E								
" F								
Specials								
Advertising								
Total for Week								

FORM 5.

PAGE 2.

Costs.	Current Week £.	s.	d.	Cost per Mile.	Corresponding Week Last Year			Cost per Mile
Petrol								
Carbide, Grease & Oil								
Tyres								
Drivers & Conductors								
Total								
Ticket Check								
Attendance: Buses								
" Garage								
Repairs: Chassis								
" Bodies								
" Buildings & Tools								
Lighting & Power								
Sundries								
Rents, Rates & Insurance								
Salaries & Management								
Total Costs								
" Receipts								
Net Revenue								
Total for --- Weeks To-Date: Costs								
Receipts								
Net Revenue		3748						

PAGE 3.

Statistics	Current Year Week	To-Date	Last Year Week	To-Date
Petrol (Galls)				
" (Miles per Gal)				
Mileage				
Passengers				
" per Mile				
Receipts per Passenger				
Costs " "				
Receipts per Hour				
Costs " "				
Costs to Receipts %				
No of Buses in Service				
Hours Run				
Average speed M.P.H.				

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MOTOR TRAFFIC.

repair necessitating more than slight attention is left for the day men to deal with. The chief men under the general foreman in the day time are the fitters, and to these are entrusted the most important work on the chassis, and none of this work should be done by the other men unless it is carefully supervised either by the foreman or one of his leading hands. One turner, assisted by an improver, should be sufficient for all lathe and machine work, as the drilling machines would be utilised by many of the other men. The blacksmith, though mostly engaged at his forge, would also be available for undertaking, with assistance, the re-tyring. The tinker repairs radiators, lamps, floats, filters, pipes and tanks, and should have a convenient part of the shop apportioned to him for this work. The two drivers, who are attached to the day staff, can be utilised for changing over a 'bus when necessary, and for taking up a duty in case of a service driver being ill. They are also available for assisting in repair work, and, as far as possible, should be put on to rectify defects which might have occurred with them on the road. With this system of changing all the drivers round on these duties, it is obvious every driver will, in time, reach a high standard of efficiency, which will surely have its effect on the reliable running of the vehicles. As one of the drivers should always be on duty when the 'buses are on the road, they could also be used for "petrolling" the vehicles as they come in at night. They would be assisted in this by one of the handymen. The carpenter, in addition to his being able to deal with the coachwork, could also assist in much of the other repairs. The duty of the day cleaner would include the thorough washing-out of each 'bus, once every fortnight or three weeks.

It is hardly within the scope of this paper to deal with the amount of wear which does and may occur to the different parts, but the question of how many miles a vehicle should run before it is brought in to be thoroughly overhauled and examined, regardless of whether it appears to be necessary or not is one which the manager and engineer has to decide. I expect a good many engineers have found out what damage may arise from the floating about of a loose bolt in one of the gear boxes; also, what an extraordinarily easy thing it is to get a loose bolt. I should place the necessary period for this examination somewhere between 2,000 and 3,000 miles. Both the change-speed gear and the differential should be opened out for inspection, and special attention paid to all bearings, gears and bolts, and replacements made where necessary. The engine is probably the easiest portion of the chassis in which to detect any defect when in every-day use, but even in this case it is necessary to go thoroughly over the valves, circulating pumps, governors, bearings, and the big-end bearing-bolts in particular. Steering gear is also an important point. Valves on engine should be ground in, probably, about once a fortnight.

Night Duties.

An efficient night foreman and a good staff of men are very essential for reliability in running. In the night, the service vehicles have to be gone over and made ready for the next day's work, and, therefore, the various duties of the different men should be carefully assigned, and it is the greater part of the work of the night foreman to see that these duties are carried out. The night foreman, when coming on duty, must first carefully go through the log-sheet reports of the drivers, and, in accordance with these reports, see that various items are attended to by those men who have to discharge that particular work.

Ignition Attendants.—Referring to the table (Form 3), there are two men who are called sparking-plug or ignition attendants, and these men are responsible for the magnetos and igniters. The igniters should be examined every night, and thoroughly overhauled, cleaned, and re-timed every three or four nights. The magneto must be examined and cleaned every night, with special reference to the rubbing contact. The switches also have to be cleaned, in order to ensure a good contact. In addition to this, the igniters that are carried as spares must be examined for their fitness, and, when a driver has reported that he has changed one of the igniters on the road, this igniter has to be made good, and care should be taken to see that no faulty igniter is sent out the next day.

Brakesmen.—All the brake blocks on hand, foot, and wheel brakes have to be taken up and adjusted every night, and the various brake pins and levers oiled and greased. Each brakesman is given a certain number of vehicles to do, but, in the case of re-blocking, the two brakesmen would have to assist each other. In addition to this work, the brakesmen also have to examine chains (if vehicles are chain-driven), and boil and grease same when necessary. They also have to grease axles, differentials, and change-speed gears.

Lamp Attendant.—In the case of acetylene lighting on the Lewis system, two generators have to be re-charged every night, and paraffin lamps cleaned, trimmed, and re-filled.

Cleaners.—Each body cleaner should wash and clean about four 'buses per night. The engine cleaner should clean from six to seven engines, and fill all the radiators.

Oiling.—All oil cups and tanks should be filled by the handy man, who, when this has been accomplished, should assist the night foreman in any special small repair work that has to be done.

Log Sheet.

Every man, both on the day and night staff, must sign the log sheet for the work he has done during day or night. For this purpose a daily vehicle log sheet is provided (Form 4).*

Under the heading "Report of Driver," the report of the driver is entered and signed, and, if two drivers are on the same vehicle during the day, each must sign the report. In the next column, all repairs are set forth and signed by the man executing those repairs. Every entry in the drivers' column should have a corresponding entry in the other column, stating what has been done with reference to any driver's report. In the column "Work done" are printed the various duties (which, of course, may differ somewhat according to the make of 'bus) of the night staff, and every man has to sign his name against his own particular work. By making the men sign in this way, a certain check is put upon their work and, moreover, the responsibility, in the case of any trouble, is definitely fixed, and the offender can easily be brought to book. The log sheets are signed by the general foreman in the morning, and laid before the manager and engineer, who can see the exact history of any vehicle per day. By filing the log sheets away in a suitable cover, the history of each vehicle is kept in a complete form, and one capable of easy reference. On the log sheet, space is also provided for recording tyres, but this is more fully dealt with under tyre records.

Drivers.

That the provision of thoroughly-trained and competent drivers is an essential factor for successful operating is a statement which it is almost too obvious to make. The greatest care should be exercised in their selection. At the present time, good, reliable, and experienced drivers are not numerous enough to be picked up at a moment's notice; in most cases, therefore, it is necessary to engage inexperienced men, and to train them. In the first instance, each man should be medically examined for physical fitness. If sound and possessed of good average intelligence, he can begin by making himself generally acquainted with the mechanism by travelling with an experienced driver, and reading up a simple text book, so that he gets some sort of insight into the general working. After a time, he would be allowed to take hold of the handles, and gradually to get into the way of driving, until he has become fairly proficient, and can be passed by the road inspector as capable of driving the vehicle. This part of his training will probably take at least a month, and he will, by that time, have appreciated what are the most important parts with which he has to make himself thoroughly acquainted. When, therefore, he goes into the garage, he will be able to make the most of his time, and will then more fully appreciate the importance of the various work he is set to do as part of his course of training. Very careful attention should be paid in teaching him the following important points:

1. Method of taking up brakes (foot, hand, and wheel).
2. Adjustment of clutch and clutch stop.
3. The changing and re-timing of an igniter.
4. The cleaning of contacts on magneto.
5. How to take carburetter to pieces and clean jet.
6. The detail in connection with pressure system (if petrol is pressure-fed).
7. The acetylene lighting.
8. The system of lubrication.

After about three weeks to a month, he would probably be pronounced by the shed foreman as having satisfactorily passed the practical training, but, before he is passed out as a competent driver, he should be made to go through a written examination, in which the questions are framed on the work he has done. The written answers are filed with his papers, and form a record which might at some future time come in very useful. We will presume that he has now satisfied his superiors, and that they have sufficient confidence to allow him to start driving. Any such new driver should be first of all placed on the easiest routes, and then gradually worked on to those which require the more skilful men. By periodically getting him back in the shed, as before described, by the end of the year he is a competent driver, and at the end of two years a really experienced man, who could be trusted to take a vehicle anywhere and almost any distance.

* Note.—The items under "Work Done" on the Log Sheet more especially refer to a Milnes-Daimler vehicle.

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MOTOR TRAFFIC.

Inspectors.

The business of the road inspectors, besides checking tickets and making reports relating to traffic, should be to see that the drivers are carrying out their duties in a proper manner. For this reason, the inspectors should be trained drivers, and thoroughly acquainted with the work the driver has to do. They will then be in a position for reporting cases of reckless driving, the reason for a driver's not keeping time, and the nature of breakdowns, and they would also be a great help in remedying small faults that may occur on the road.

Clerical Staff.

Without going into details, I will briefly indicate the various duties as follows: chief clerk, attends to all ordering and accounts; senior clerk, tyre mileage and traffic records; correspondence clerk, all correspondence, filing, etc.; junior clerks, tickets and general assistance.

The time-keeper and store-keeper, whose offices could be combined, attends to the men's time and delivers out all stores. There is always one of these men on duty, both day and night. No stores should be given out unless a proper order is received, duly signed by some authorised person.

Spare Parts.

It is very essential to keep a good stock of spare parts of all descriptions, and most careful attention should be paid to the obtaining of parts of absolutely the correct size, and made out of the most suitable material at the least possible price. Now, speaking generally, I believe that makers, as a whole, have scarcely yet realised that, by supplying spares at a reasonable cost, they would not only keep this portion of the trade in their own hands, but would greatly assist small owners to keep down their working costs, and so encourage the use of the machines they make, thereby increasing their output in new vehicles. I think I am right in saying that the great majority of spare parts purchased to-day by the London companies are obtained from firms who are *not* motor manufacturers, but, while a large company can obtain considerable advantages from these firms, owing to the extensive orders it can place for spares of one kind, a small company generally has to go to the makers of the vehicles. This evil, if I may call it so, and from a user's point of view it is a great evil, will no doubt right itself again in time; in fact, now that there is a lull in the output of motor omnibuses, manufacturers have already considerably reduced their prices; but there is still room for improvement, and, therefore, a reduction in the cost of running can be confidently looked forward to in this direction.

Tyres.

Records of tyre mileage require to be kept with the greatest accuracy, particularly, when tyres are purchased from the makers on a mileage basis. For this purpose, a space is provided on the daily log sheet (form 4), for noting the numbers of the tyres on each vehicle, and also for recording any changes that may have been made during the period covered by the log sheet. These records should be checked every day against "Tyres issued from stores," for, when a tyre is issued, it is put either on a wheel that is on a 'bus, or on a spare wheel. This check, therefore, prevents the possibility of a change without notification.

The daily mileage is ascertained from the 'bus-mileage sheets, entered by the conductors, who have to record the number of journeys run on each route, on a sheet corresponding with the number of the 'bus. The mileage clerk having been supplied with the tyre numbers, and the mileage run by each 'bus every day, can therefrom make up the mileage of tyres for each week in a special ledger, and the tyre makers can be furnished with a weekly statement of the mileages and failures of the individual tyres.

One of the most necessary points, which should be verified at the outset, is the mileage of each route, and probably the most satisfactory method of ascertaining this is to measure the route with a pedometer. This should be done in the presence of a representative of the tyre makers, so that any question as to the route mileage which might arise later when the mileage of the tyres does not come up to the makers' expectations, is once and for all settled.

Costs.	Current Week £.	s.	d.	Cost per Mile d.	Corresponding Week Last Year £.	s.	d.	Cost per Mile	Statistics	Current Year Week	To-Date	Last Year Week	To-Date
Petrol	47	10	0	1·392					Petrol (Galls) 8d.	1425			
Carbide, Grease & Oil	7	3	5	·210					" (Miles per Gal)	5·75			
Tyres	68	5	0	2·000					Mileage	8,190	425,880		
Drivers & Conductors	61	10	0	1·802					Passengers	50,000	260,000		
Total	184	8	5	5·404					" per Mile				
Ticket Check	5	11	3	·162					Receipts per Passg	2d.			
Attendance: Buses	18	0	4	·528					Costs " "				
" Garage	4	10	0	·132					Receipts per Hour				
Repairs Chassis	54	13	2	1·602					Costs " "				
" Bodies	3	17	4	·113					Costs to Receipts %	89·8			
" Buildings & Tools	3	0	0	·088					No. of Buses in Service	20			
Lighting & Power	2	0	0	·059					Hours Run	1,100			
Sundries	5	10	0	·161					Average Speed. M.P.H.	7·5			
Rents, Rates & Insurance	19	5	0	·564									
Salaries & Management	21	15	4	·639									
Depreciation	48	0	7	1·408									
Total Costs	370	11	5	10·860									
" Receipts	409	10	0	12·000									
Net Revenue	38	18	7	1·140									
Total for 52 Weeks — Costs	19,269	13	8										
Total for 52 Weeks — Receipts	21,294	0	0										
To-Date. Net Revenue	2024	6	4		3749.								

Form 6.

Cost Cards.

One of the chief duties of the clerical staff should be the getting out, every week, of details of the receipts and cost of running, and the various books and records should be so framed as to enable this to be done with as little trouble as possible. Form 5 shows an arrangement of a weekly cost card, which can be folded in the middle, and conveniently carried about in the pocket.

On the front page of the card are tabulated the details of the receipts, the upper portion showing the total receipts for each separate day, whilst the lower portion shows the total amount taken on each route for the whole week, with the receipts per car-mile worked out in a separate column. As the weather, in most districts, has a bearing on the receipts, it is interesting, for future reference and comparison, that this should be recorded, and a column against the daily receipts is provided for this purpose.

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MOTOR TRAFFIC.

On page 2, on the inside of the card, are the various items of expenditure, arranged under suitable headings, with the cost per car-mile against each heading in a special column. At the bottom of this cost column is shown the net revenue and also the totals of receipts, costs, and net revenue for the number of weeks to date in the financial year of the undertaking.

On the third page, or the opposite side of card to the costs, are the different statistics which are useful for indicating the exact performance, if I may so put it, of the vehicles, and these are very helpful in the study of obtaining the best results, both from the point of view of increasing the traffic, and keeping down the working costs.

Both on the front and inside of the card, duplicate columns are shown for recording the results of the corresponding week of the previous year. This is done entirely for comparative purposes, but shows clearly the progressive or retrogressive results of the undertaking, and brings into prominence improvements or backward tendencies.

On the 4th page, or back, of the card may be tabulated the amount of petrol consumed by each 'bus, the mileage run, and the mileage per gallon.

The cost card, when completed each week, is intended for distribution among the higher officials, so that, week by week, the exact position of affairs is clearly set forth, and any beneficial alterations, which otherwise might be delayed for want of direct and early information, may at once be brought into operation. To my mind, the value of a weekly card of this description can scarcely be over-estimated, and this must be especially so in the case of a large undertaking. There is nothing more likely to assist in efficient administration and economical working than facts brought forward in hard cash, and, whilst it may add a small amount of labour on the clerical side, this extra cost will be many times repaid.

Cost of Working.

Having now got a blank cost card to suit the small system under consideration, it seems somewhat incomplete until it is filled in. I shall endeavour, therefore, to arrive at the working costs, and in doing so, I shall presume that the motor 'buses are of the latest type, and built from the experience obtained on the earlier models

The various items of cost are considered in detail, and full particulars given as to how the figures are reached. Such items as the price of petrol and labour vary appreciably in different districts, as, for instance, while petrol can be purchased at a cheaper rate in London than many other places, the wages that have to be paid there are higher. So, also, do the conditions under which the 'buses have to operate differ; it may be in a flat, or it may be in a hilly district; it may be through congested traffic, or on open country roads. In working out the costs, I have endeavoured to strike a medium for an English district, and I believe the figures given would only vary very slightly for the different localities.

It will be remembered that an average of 13 vehicles are in daily service, and each vehicle runs on an average of 90 miles per day. The mileage for a week, therefore, works out at 8,190 miles.

		£ s. d.
Petrol.		
Taking the price of petrol at 8d. per gallon for ·760 spirit, and that a vehicle runs 5·75 miles on a gallon		47 10 0
Carbide, Grease and Oil.		
Acetylene lighting, on the Lewis system: 13 'buses would use 130 lb. of carbide per week at 2d. per lb.	£1 1 8	
Cartridge papers, 200 per week, at 3s. per 100	0 6 0	
Lubricating oil, taking 1 gallon at 1s. 6d. to every 150 miles run	4 2 6	
Grease, 72 miles per lb., at 3½d. per lb. ..	1 13 3	
		7 3 5
Tyres.		
Mileage contract, at 2d. per mile		68 5 0
Drivers and Conductors.		
To arrive at this cost, it is necessary to approximate the average speed: I put this down at 7·5 miles per hour, which includes waiting and reporting time. Paying drivers at 7½d. per hour, and conductors at 5½d. per hour, the amount comes to	£59 15 0	
Allowance for uniforms	1 15 0	
		61 10 0
Ticket Check.		
Salaries, 2 inspectors at £2	£4 0 0	
Uniform allowance for inspectors	0 2 6	
Tickets (50,000 at 4½d. per thousand) ..	0 18 9	
Punches (45 at rental of 12s. per annum) ..	0 10 0	
		5 11 3

Attendance, 'Buses.

Under the heading of attendance comes nearly all the work of the night staff, and, whilst they may execute some work which is in the nature of a repair, so also may the day staff do some work which might be allocated to attendance. For the purpose of this paper, I have put all the wages of the night staff under this heading, and, assuming the men work 56 hours per week, this is made up as follows:

	£ s. d.	£ s. d.
Night foreman (weekly wage)..	2 5 0	
2 brakesmen, at 6½d.	3 0	
2 igniter attendants, at 6d.	2 16 0	
1 handyman, at 6d.	1 8 0	
5 cleaners, at 4½d.	5 5 0	
1 lamp attendant, at 5½d.	1 5 8	
	16 0 4	
Material, including water, rags, waste, paraffin, brushes, soap, etc.	2 0 0	
		18 0 4

Attendance, Garage.

3 time-keepers and store-keepers, 8 hours per day, at £1 7s. 6d. per week	£4 2 6	
Heating apparatus	0 7 6	
		4 10 0

Repairs, Chassis (including engines):

Wages of the day staff, with exception of carpenter, are included under this heading, but foreman's salary comes under salaries. 56 hours per week:

2 fitters, at 8½d.	£3 19 4	
1 blacksmith, at 8d.	1 17 4	
2 drivers, at 7½d.	3 10 0	
1 tinsmith, at 8d.	1 17 4	
1 turner, at 8d.	1 17 4	
1 improver, at 4d.	0 18 8	
2 handymen, at 6d.	2 16 0	
2 labourers, at 5½d.	2 11 4	
1 cleaner, at 5d.	1 3 4	
	20 10 8	
Material, including replacement of spare parts, calculated at 1d. per mile	34 2 6	
		54 13 2

Repairs, Bodies:

1 carpenter, at 8d. per hour	£1 17 4	
Material, including paint and varnish ..	2 0 0	
		3 17 4
Repairs, Buildings and Tools (Estimated)		3 0 0
Lighting and Power (Allowance)		2 0 0
Sundries.		
Printing and stationery	£2 10 0	
Advertising	1 0 0	
Cleaning offices and sundries	1 0 0	
Petty cash	1 0 0	
		5 10 0

Rents, Rates, Taxes and Insurance:

Fire and ignition risk on 'buses, 10s. per cent. on £18,000	£90 0 0	
Insurance or amount set aside for 3rd party claims	700 0 0	
Inland Revenue licenses, 20 at £3 18s.	78 0 0	
Workmen's compensation; wages, £5,000 at 12s. per cent.	30 0 0	
Fire insurance on buildings and stock, say, £5,000, at 2s. 6d. per cent.	6 5 0	
Rates and taxes, assessed at £200, at 6s. 8d. in the £	66 13 4	
Licenses (petrol, carbide, police licenses for 'buses, drivers and conductors)	7 5 0	
Telephones, fidelity guarantee, etc., say ..	23 0 0	
1-52nd of	1,001 3 4	=19 5 0

Salaries and Management:

Engineer and manager, per annum	£450 0 0	
Clerical staff ,, ...	500 0 0	
General foreman ,, ...	182 0 0	
1-52nd of	1,132 0 0	=21 15 4

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MOTOR TRAFFIC.

DEPRECIATION :

The amount to be set aside for depreciation should really come in at the end of the year, but, in order to make costs complete, it is necessary to put amount in cost card. It will be remembered that these 'buses under consideration are of the latest models, and that mileage run does not average more than 21,000 per annum, and, therefore, if it is correct in most cases to reckon depreciation at 25 per cent., in this case 15 per cent. should be an ample allowance. Even after 7½ years, the vehicles should be worth something, so that if their whole value is depreciated in this period, 15 per cent. should be a very fair figure.

	£	s.	d.	£	s.	d.
Assuming, therefore, that each vehicle cost £800 without tyres, the amount set aside for depreciation, for 20 vehicles, is	2,400	0	0			
Depreciation of buildings, costing £3,000, at 2 per cent.	60	0	0			
Tools and office furniture, £750 at 5 per cent.	37	10	0			
1-52nd of	2,497	10	0	= 48	0	7
Total ..				£370	11	5

By inserting the foregoing figures in the cost card (Form 6), and by following them out for the 52 weeks in the year, and filling in receipts at a shilling per mile, the profit amounts to £2,024 6s. 4d. From this must be deducted, in the case of a municipal undertaking, the amount set aside for the sinking fnnd, and, in the case of a company, the expenses of the secretary's office and the fees of the directors. There should, however, be sufficient left to pay a fair return on the capital expenditure, which would be somewhere in the neighbourhood of £25,000.

Now, it will be seen that the total working costs, including depreciation, come out at 90 per cent. of the total receipts, and herein lies the difficulty, to my mind, of the advance in the more general adoption of motor 'buses. To tramway managers and engineers, the sum of 1s. per mile is a high figure to take in, for 10d. is nearer the average on most tramways in the country, and, moreover, the electric car can accommodate some 55 to 60 people, whilst the motor 'bus only 32 to 35.

REDUCTION IN WORKING COST.

The cost of working must, therefore, be reduced, and the items which are capable of being worked on to bring about this reduction are: petrol; oil, grease and carbide; tyres; repairs and attendance; and insurance.

Petrol is probably, at the moment, the most likely item capable of reduction (unless there is a petrol famine). By careful management, coupled with the latest improvements, I think that the figure put down on the cost card, can be made to show a marked decrease. Lubricating oil, whilst not such a large factor, is still a considerable item of expenditure, and, by use of just the most suitable oil, and by careful economy, the oil bill should be very considerably lowered.

Tyres may be described as the "dead weight" of the motor omnibus, pulling it down all the time. The tyre makers are the most likely to be able to say whether there is any prospect of a reduction in the near future. It would be most interesting to know their views on the subject.

Repairs and attendance, according to my figures, when added together, come to 2½d. per 'bus mile, which certainly seems a large amount, but, as far as the labour portion is concerned, I think road vehicles going at a speed of 12 miles an hour and upwards, and carrying the prime agency of propulsion, will be some time before they are perfected so as to allow any considerable reduction in the number of men to keep them in order and repair. On the other hand, the price of spare parts is sure to come down, so that a saving may be anticipated in this direction.

Insurance, or the amount set aside for third-party claims, is largely a question of tyres. As soon as the skidding propensities of the motor vehicle are diminished, the premiums will be reduced. The skill of the driver is no doubt being improved by experience, but the fact remains that, given a certain state of the road, skidding is likely to occur, and, until a long-mileage non-skid tyre comes into universal use, the insurance companies' premiums will be high.

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MOTOR TRAFFIC.

UNIFORMS.

Much more attention than formerly is now paid to the equipment of the employees of railway, tramway, motor 'bus, and motor cab companies, with suitable uniforms for the class of work performed by the men. In the days of the old horse car there was nothing in the nature of a uniform supplied to the men, but the progress of electric traction in this country, and the consequent improvement in the mode of travel from point to point has led to considerable emulation among the various tramway undertakings, with the result that at the present moment the uniforms worn by the men are of a particularly neat and suitable character. Moreover, an entirely new industry has been formed, and has brought in its train the supply of uniforms and liveries to motor 'buses and motor cab companies.

Some recent enquiries as to the output of the various firms engaged in the manufacture and sale of uniforms have revealed the fact that the trade has of late greatly increased, and it is surprising to find how large a number of undertakings, more particularly in connection with tramways, is now supplied by, amongst other well-known firms, Messrs. H. Lotery & Co., of 4 to 8, St. Mary Street, London, N.E.

An inspection of the works of this firm is both interesting and instructive. There are two thousand workpeople employed by this firm who work under exceptionally good conditions. During a recent visit we noticed work being executed for the Great Northern, the

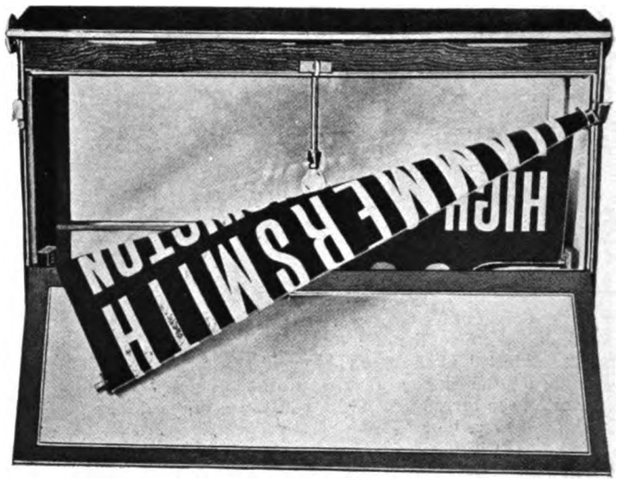
Great Central, the North Eastern, the London and South Western, and a number of smaller railways. The tramway work in hand consists of exceptionally large orders for the majority of the tramway undertakings owned by corporations and companies in the country, and the work also includes police forces, motor cab companies, hotels, music halls, and in fact every class of uniform and livery used.

Among orders lately completed by this firm are the handsome liveries now being worn by the drivers of the red taximeter cabs at present plying for hire in London, and owned by the General Motor Cab Co. The design of these uniforms has received special attention, and it will be agreed upon inspection of the illustrations, that the fit is excellent in every way. The cloth is a particularly smart colour, being a mixture of blue and French grey. This identical cloth has been specially manufactured, and is at present in use in the Roumanian Army. If any tramway manager is in doubt as to the class of uniform likely to suit the district in which he is interested he cannot do better than visit one of the large factories, and inspect the great variety of cloth and patterns which Messrs. Lotery and Company manufacture.

THE FORTHCOMING MOTOR SHOW.—The Society of Motor Manufacturers and Traders have appointed the following sub-committee to superintend arrangements for the second international commercial motor vehicle exhibition: Messrs. E. Manville, president of the society; Burford, of Milnes-Daimler; Bonsor, of Darracq-Serpollet; Brampton, chairman of the accessories section; Gascoine, of Armstrong-Whitworth; Goodchild, of Lacre; Johnson, of Rolls-Royce; Miles, chairman of the marine section; and Straker, of Straker and Squire. The exhibition will be held in Olympia, London, from March 26 to April 4 next.

"METROPOLITAN TYPE" DESTINATION INDICATOR.

This indicator, illustrated below, was especially designed by the Consolidated Electric Company for the Metropolitan Steam Omnibus Company, of Hammersmith, London. It is arranged to show four destinations at once, three intermediate destinations and the terminus, thus doing away with the use of loose painted boards, as is necessary when the indicator only shows one destination.



The box is strongly constructed of well-seasoned American quartered oak, all joints dovetailed, glued and screwed. In this design the front is fixed, owing to the size and weight of the glass, the screen being removed through the rear door. With this exception the general method of operation and design of fittings, screen, etc., is similar to the standard models shown in this firm's catalogues.

The screen is operated by means of four fixed handles, thus ensuring perfect tension on the rollers. Two light wood mouldings with metal clips are arranged to be sprung into position in the interior of box over

the ends of screen, keeping the screens flat and preventing the light from showing through the front. The front of the box is finished with an ornamental moulding, the whole of the exterior being stained and varnished with two coats of best outside varnish. The indicator is designed to be illuminated at night by means of four 4-candle power electric lamps.

THE METROPOLITAN ASYLUMS BOARD have accepted tenders by Dennis Brothers, Guildford, for two motor 'buses, each to seat 16 persons inside, at £640 each, and one motor 'bus to seat 10 persons inside, at £600. The prices are exclusive of tyres.

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THE Tramway & Railway World
A REVIEW OF CURRENT PROGRESS IN ELECTRIC AND OTHER TRACTION

ESTABLISHED 1892. LONDON, FEBRUARY 6, 1908. VOL. XXIII.

THE MONTREAL STREET RAILWAYS.

Montreal is the largest city in Canada, and is claimed to have a population of 400,000. To the stranger it is a difficult city to estimate. Business is said to be thriving; the city is wealthy, but it does not show to the same advantage as either Quebec, with its 80,000 inhabitants, or Toronto with its 300,000. Montreal's large buildings are built of a dark-coloured stone, rapidly blackening, like the buildings of Toronto, with the smoke that is literally belched forth from every factory chimney, and shrouds the city in gloom. The nuisance is not abated by the steamers on the river, nor by the locomotives on the railways, which, being worked on the American system of the short and merry life, cannot be fitted with the essential brick arch owing to the boilers being washed out hot. As in London, there is much talk but little done to abate the smoke, and the appearance of the city is greatly spoiled.

Like so many towns in America, Montreal is very poorly paved. Seen from the summit of Mount Royal, that volcanic upheaval which shelters a great portion of the length of the city from the northerly wind, Montreal is a veritable city of beauty, marred only by the smoke from its factories. The whole city appears to be a dense leafy wood, since so many streets are well supplied with trees, and there are numerous small squares and back yards and gardens in which trees grow. The city is stretched out on the area of land lying between the St. Lawrence River and Mount Royal. It consists of a series of long streets roughly parallel with the river, and crossed by numerous transverse streets which extend towards the mountain. To the

A Typical Scene in Winter on Montreal Street Railways.
(Men are seen clearing away the snow after the passing of a car with snow-plough attached.)

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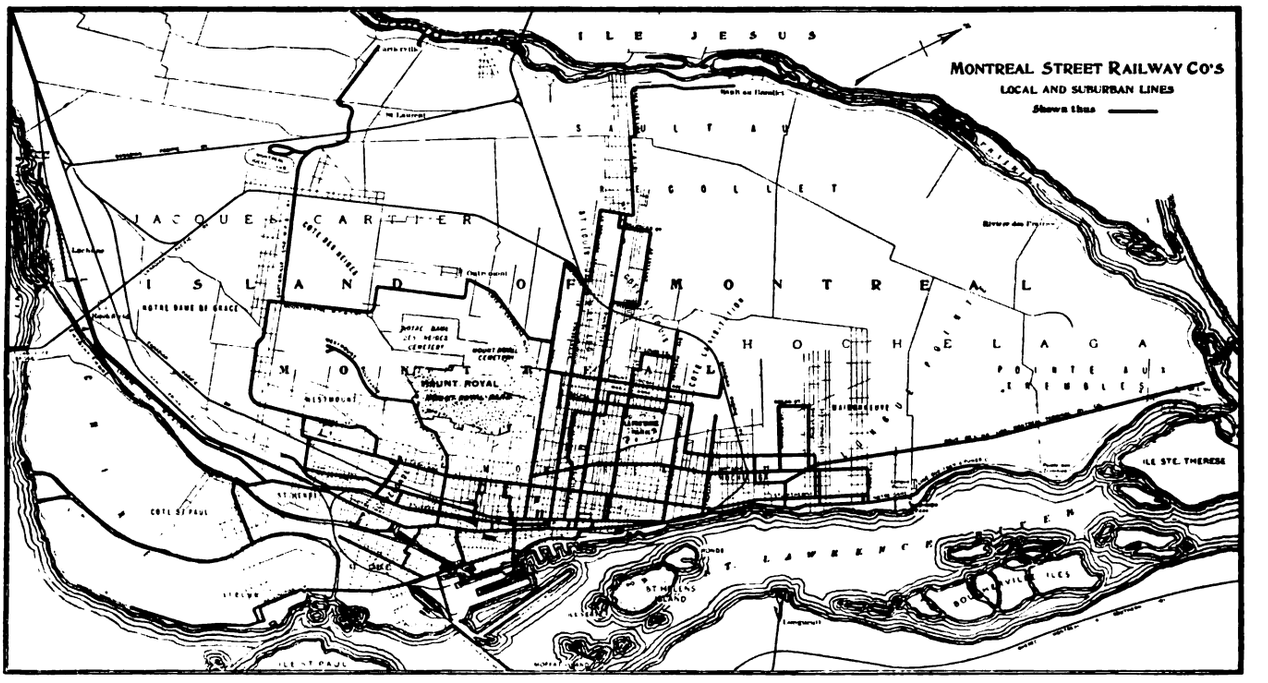
badness of the paving may, perhaps, be attributed the great use of the tramways. There is also a good system of transfers, so that while the charge for a short journey is 2½d., this sum will also cover a journey of considerable length. The city is about four miles in length, and there are on an average about seven principal streets, which run approximately parallel with the river, but since the city narrows to the east these long streets finish, and, like a metalliferous vein, disappear one by one until at Longue Point they have diminished to one.

The main lines of tramway are those along Notre Dame, St. James', Craig, Ste. Catherine's and Ontario Streets, east and west, while the cross lines are principally those on Windsor Street and St. Laurent Avenue, St. Denis, Bleury, with many other cross street lines of shorter lengths. Strictly speaking, Montreal lies not far from N.E. and S.W., but these directions are simplified to east and west, and these easts and wests are measured from St. Laurent Street or the Boulevard, which also is assumed to be the dividing line between the French and English parts of the city. Lines extend right across the island to the Riviere des Prairies at two points, Cartierville to the west of the mountain, and Sault au Recollet to the east, the mountain forming an untouched area of nearly 2 miles by 1⅛ miles, save that a cable line runs from Park Avenue at a very steep grade nearly to the summit, and the mountain is "encircled" by what is known as the Mountain Line, from which good views are obtained.

At the close of the last financial year there were 54 miles of double and 14 of single track, 218 double-truck cars and 321 single-truck cars with summer equipment. There are, in all, 1,400 motors of 25 to 50 H.P., the standard motors being of 40 H.P. A considerable number of the cars are of great size, with a pair of equal four-wheel trucks and a four-motor equipment. These cars are very powerful, take the steep hills without a pause, and are fitted with large end platform at the rear—the cars run always one way—for the "pay as you enter system," which works well here, and is appreciated.

In a 28 days' period the car mileage was 1,104,432, with car hours 142,772, representing an average speed of 7·7 miles per hour. In the same period the passengers numbered 6,368,992, and the receipts 22·74 cents. per car mile, or but little below the proverbial shilling. The net payment per passenger thus works out at just under 4 cents, which is almost the same as the figure for Toronto, and shows that the similar system of tickets with cheap fares and special tickets gives an all-round rebate of 20 per cent.



Map of Montreal Tramway System.

Transfers are freely given and used in about the same ratio as at Toronto, namely one to each three fares, many people taking a transfer as a proof of having paid a fare. As may be judged from the lay-out of the city with a 700 ft. mountain right at its back, the rise of the cross streets is very rapid in places, especially opposite to the central parts of the mount. Hence the need for the powerful equipment of the large cars, which though having a long overhang do not pitch. The long overhang, however, throws over the end of the car a long way laterally when taking curves.

Power is obtained from several sources. There is, first, a steam power-station in the city, and electricity generated by water is brought from Shawinigan, from Lachine, and from Chambly. The Shawinigan Water Power and Electrical

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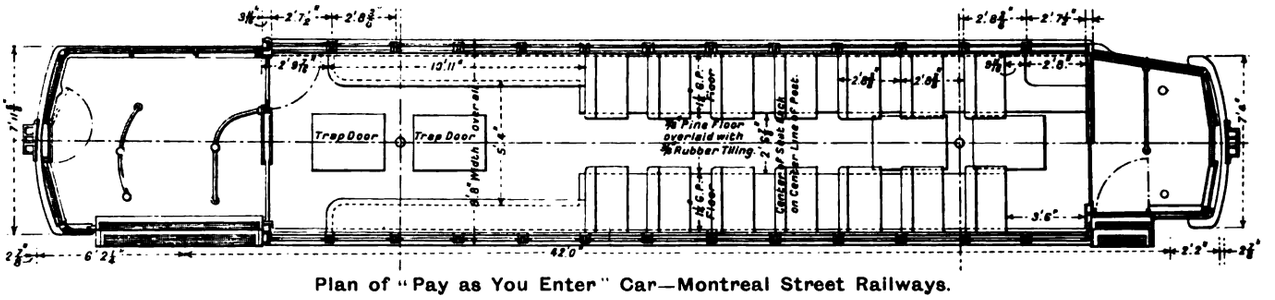
Transmission Scheme has been mentioned in these columns, and is well-known. The Lachine power scheme shows what can be done with the more modest falls of this country. The power-house stands on a long dam near the foot of a portion of Lachine rapids, which form the limit of ocean navigation of the St. Lawrence River. In the course of Lachine rapids the river is said to fall about 45 ft., and a considerable part of this fall has been made serviceable by throwing out a long dam from the river bank at a spot not far from the foot of the rapids. From the end of this dam, a wall is extended up and down stream, thus forming a canal, the head of which takes in water from the river at a considerable elevation above the tail of the rapids, which provides at the site of the dam a tail race level as low as the foot of the rapids. On the dam stands the power-house, a narrow building of great length containing the generators and turbines, the intakes of which are through grids and sluices on the west faces of the dam, and the turbine discharges are at the foot of the dam on the east side.

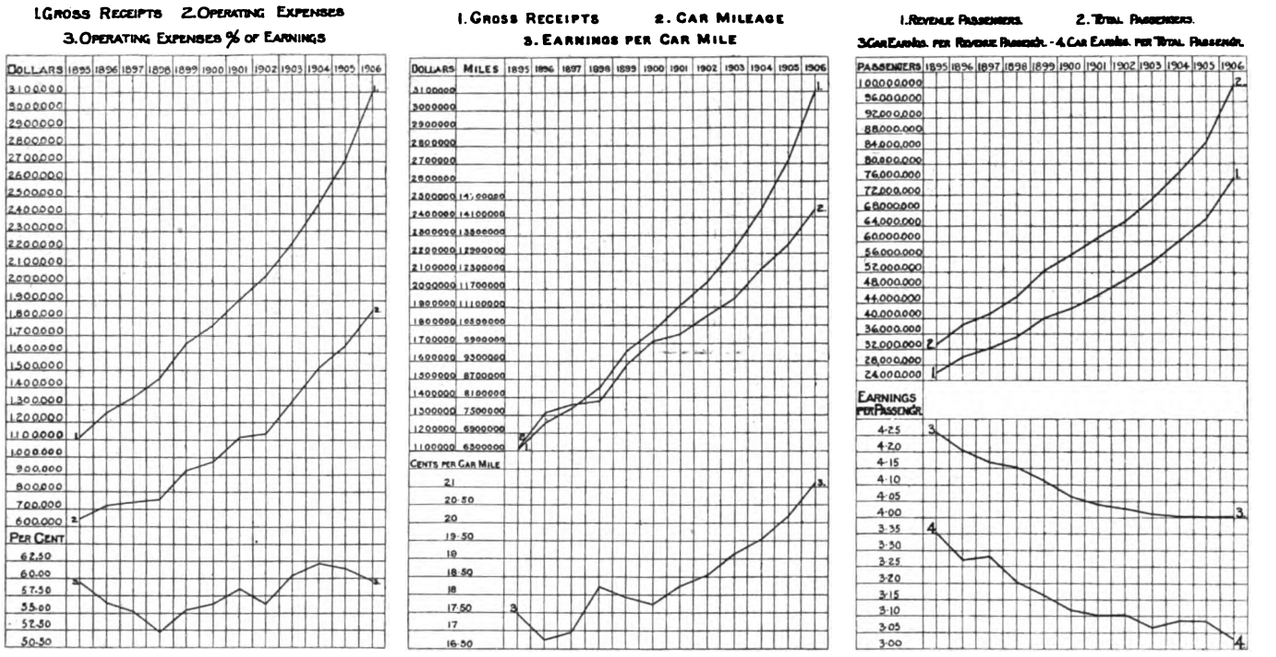
While the accompanying diagrams give at a glance some interesting and useful comparisons, the following statistical table shows clearly the position at the close of the financial year, 1906:

Gross receipts	$3,100,486 (£638,000)
Expenses	$1,850,719 (£380,806)
Percentage of earnings	59·69 per cent.
Net earnings	$1,249,766 (£257,194)
Net return on capital	12·96 per cent.
Passengers carried	76,356,099
Car earnings per passenger	4 cents. (2d.)
Transfers	24,516,067
Total passengers (all transfers added)..	100,872,166
Net earnings per passenger	3·03 cents. (1·5d.)

In this table the total passengers are made up by adding transfers to tickets and fares collected. Compared with the year 1895, every figure except the four small items has approximately been trebled. The financial statement shows that the capital of the company amounts to $9,509,367, or £1,900,000, made up as follows: Capital stock, $7,000,000; 5 per cent. bonds, March, 1908, $292,000; 4½ per cent. bonds, August, 1922, $681,333·33; 4½ per cent. bonds, November, 1922, $1,500,000·00; Mortgages, $36,034·51.



Plan of "Pay as You Enter" Car—Montreal Street Railways.



Records from Montreal Street Railway Accounts.

The percentage on earnings paid to the city is a very much smaller item than in the case of Toronto, where, for an approximately identical gross income, number of passengers, working expenses, etc., the city appropriated nearly double as much as in Montreal, or £69,783, and the difference is partly seen in the four quarterly dividends on the common stock of 1½ per cent,

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at Toronto and 2½ per cent. at Montreal. For such equal systems, other comparisons of interest may be made. The capitalisation, for example, differs somewhat, and while apparently more extravagant at Toronto, that city has probably a better track and less snow in winter, and comes out better in the lower percentage of operating expenses, while it carries more passengers on a much smaller population. But Toronto is essentially a city with suburbs; everyone apparently lives away from the city proper.

The electric railway system of Montreal, as of other Canadian cities, has turned very largely on the ability to keep traffic going in winter. Snow plows, salt cars, and sweepers combine to keep the tracks clear, no matter how serious the storm. The weather bureau of McGill College shows an average annual snowfall during fifteen years of 117 in. a year—an amount that is probably not equalled in London in twice fifteen years. Moreover, the winter operation of the Montreal lines varies from 52 per cent. of the receipts in summer, to 70 per cent. in winter. Clearly efforts have been great to keep the tracks clear.

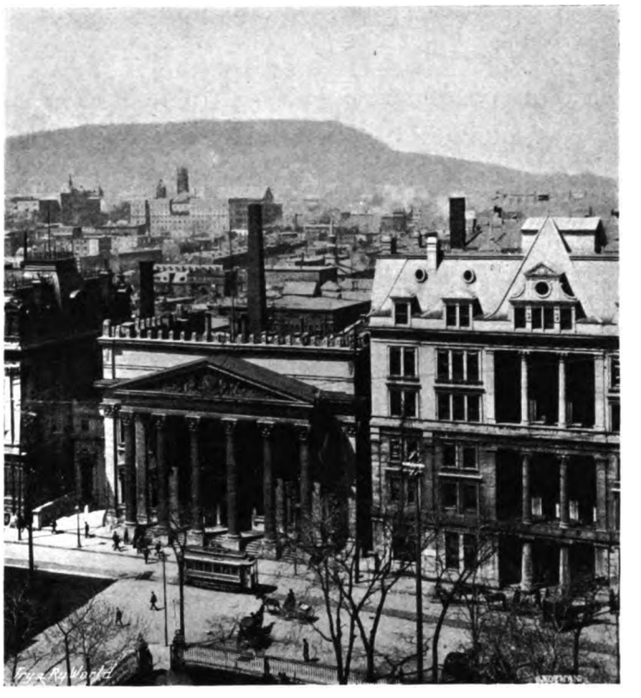
The present rails are of a T section, 87 lb. per yard, and laid with a concrete stringer, steel ties and rods, the groove being cut in the paving blocks as less noisy, and presenting less obstruction in winter than a grooved rail.

In macadam the 87 lb. rail is laid on wooden ties with tie rods each 6 ft. On hills, and a few other places, a 96 lb. girder rail is used, but the T rail is employed wherever practicable, and the intersection work, etc., is of manganese steel, and there is no built-up diamond or other special work.

While in 1897 the average car was 21 ft. long on the body, and weighed 16,000 lb., the present large car above referred to is 35 ft. long on the body, 50 ft. long overall, carries a motor equipment of 180 H.P., seats 50 passengers, and weighs 50,000 lb., for a cost of £1,200. It has, therefore, a dead weight of 1,000 lb. per passenger, which, while it compares unfavourably with the 570 lb. per passenger of the car of 1897, seems to be unavoidable as cars grow larger. But the newer car gives more accommodation per passenger, and more comfort, and only calls for the same labour cost as the older 28-passenger car. Still with such large cars one might hope to see something greater than the 1s. per mile receipts. There are 145 cars with air brakes; all cars, in fact, over 30,000 lb. weight have power brakes, which are necessary in a hilly city like Montreal.

The steam-driven station of the company contains one 1,500 KW. generator, two of 850 KW., 6 of 300 KW., and eight of 200 KW., with four 200 KW. magnetic boosters. There are six Babcock and Wilcox boilers and 22 Lancashire boilers. The engines are one 3,500 H.P., two 1,500 H.P., six 800 H.P. Of sub-stations there are two, each having two 500 H.P. units, one with three 1,000 H.P. units, and three storage battery plants of a maximum output of 1,400 amperes each for twenty minutes. There are seven 500 KW. water-driven units at the Lachine dam, etc.

The writer is indebted to Mr. McDonald, the manager, and to Mr. Patrick Dubée for information in preparing this article. Needless to say the electrical equipment of the track is overhead span wire construction, and calls for no special comment, except that the trolley wire had very much less sag when seen by the writer in July, than would be expected with temperatures in winter a long way below zero.



Street View in Montreal.
(Showing mountain in background.)

The company works the Montreal Park and Island Railway, a country line chiefly, with a length of 46 miles of route, and also has agreed to work the line of the Suburban Tramway and Power Company to Longue Point, about seven miles in all. It also agreed last year to purchase the stock and bonds of the Montreal Terminal Railway (about nine miles of route), for which purpose fresh capital would be issued at a premium so as to minimise the interest charges. By these purchases the whole of the electric lines of Montreal are coming under one management, and while good dividends are declared, the contingent fund for renewals is kept well supplied.

Generally, the accounts show a reasonably conservative system of management, and some of our English tramways will no doubt envy such a line its ability to work its finances on such a sound basis. The large fare of five cents per passenger, or four cents average after deductions, no doubt helps to this result.

W. H. Booth.

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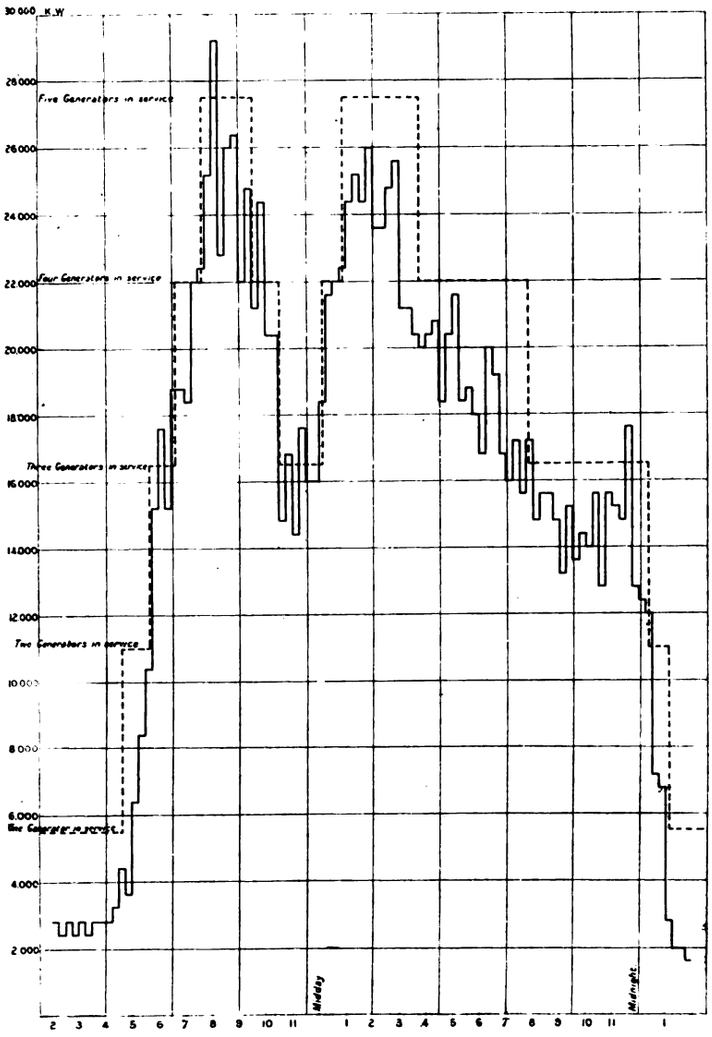
OUTPUT OF CHELSEA POWER-STATION OF THE UNDERGROUND ELECTRIC RAILWAYS.

Now that all the electric railways supplied with energy from the Chelsea station of the Underground Electric Railways Company of London have come into full operation, the station has a very large load. It has been equipped with plant which will work a much heavier traffic than exists at present, but even as things now are the output of electric energy is far in advance of that of any other electric traction power-station in the country. The output is now about 100,000,000 units per annum. Eight turbo-generators of 5,500 KW. capacity are installed, giving an equivalent of about 60,000 H.P. in all, but at present not more than five are required at any one time. The railways supplied are, it may be recalled, the Metropolitan District, the Baker Street and Waterloo, the Great Northern, Piccadilly, and Brompton, and the Charing Cross, Euston, and Hampstead Railways, as well as part of the lines of the London United Tramways. By the courtesy of Mr. James R. Chapman, engineer-in-chief to the Underground Electric Railways Company, we have been supplied with the two drawings which are here reproduced. The first is a load diagram of the station for one day—Saturday, January 4 last. It shows all the fluctuations of the load from two o'clock in the morning till two the next morning. One scale shows the output in kilowatts, while the other shows the time. The dotted line gives the normal capacity of the machines in service. The points where the additional generators were brought into service as the load increased, and cut out as the load diminished, are also marked. It will be noted that the engineers in charge followed the fluctuations very closely in starting and shutting down the generators. The day being a Saturday, the second peak of the load came in the afternoon, instead of in the evening. The heaviest demand was at 8 a.m., when 29,200 KW. was reached, while the afternoon maximum was 26,000 KW. The effect of the theatre rush, near midnight, is quite plainly shown.



Chelsea Power-Station Load Diagram for January 4, 1908.

The following data collected from the diagram may be of interest: Total generator hours, 78 hours 57 minutes; normal capacity corresponding to the above, 434,225 kilowatt-hours; total output for 24 hours, 376,800 kilowatt-hours; percentage of output to normal capacity, 86·77 per cent.

As January 4 was a frosty day, the electric heaters on the District Railway trains were in use, and this caused a material addition to the load. On the three tube railways, heaters are not in use, as the lines are at such a depth that the atmosphere in the tunnels and trains is comparatively warm. About 5½ kilowatt-hours per hour are required for heating each District Railway car, so that with a twenty-hour day, and an average of 300 cars in service, the energy consumption for heating is about 33,000 kilowatt-hours (or units) per day, or over 8 per cent. of the total output of 376,800 units on this particular day.

In regard to the load shown by the diagram of from 2,400 KW. to 2,800 KW. between two and four in the morning, this represents current used for lighting the tunnels for the permanent way maintenance men, lighting the trains in the yards and sheds for the cleaning staff, lighting depôts, moving cars in the sheds, and heating the cars to a certain extent in the yards during cold nights so as to keep all the compressed air mechanism in proper order. The load never falls below 1,000 KW. during the time when no trains are running.

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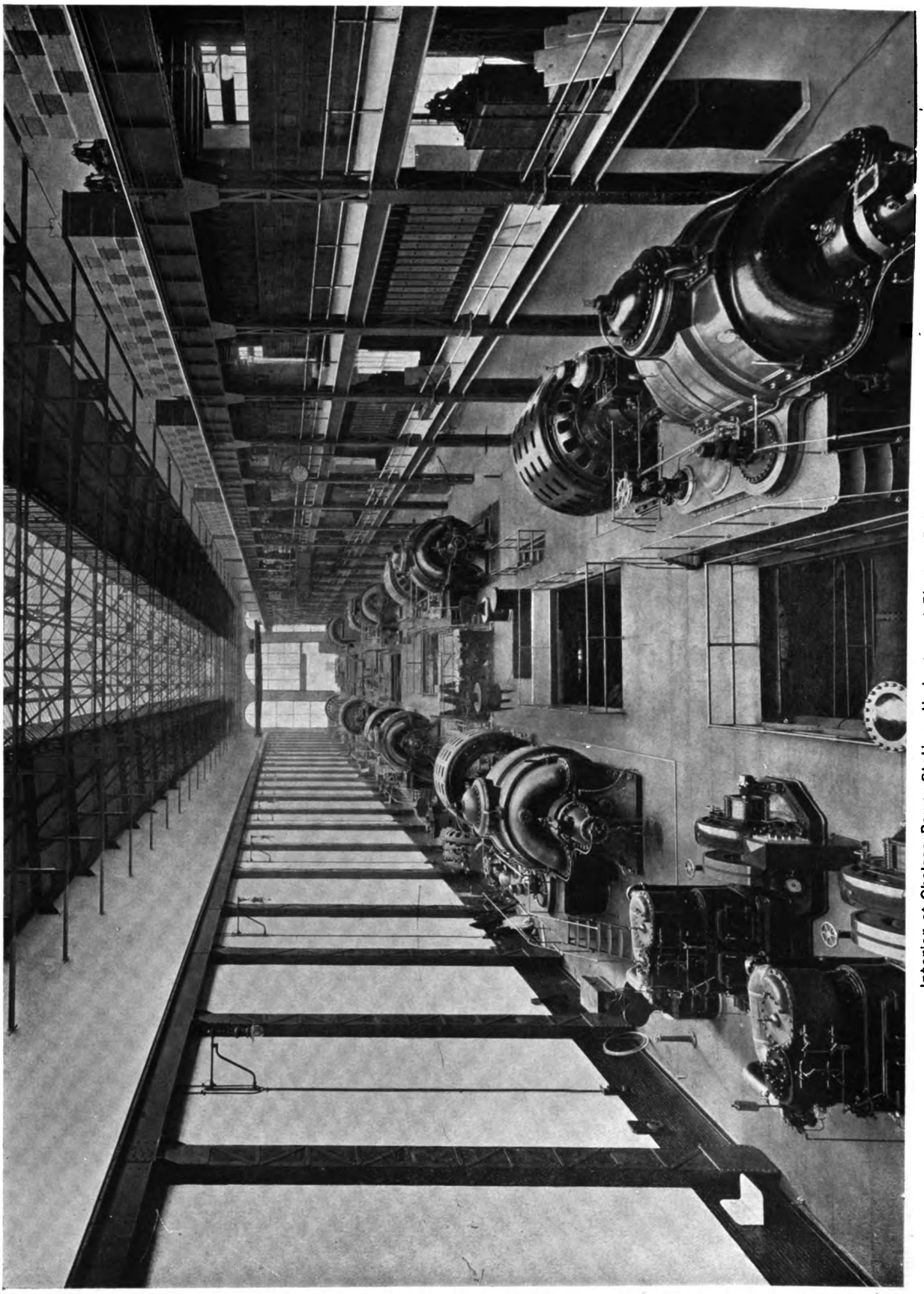

Interior of Chelsea Power-Station—Underground Electric Railways Company of London.

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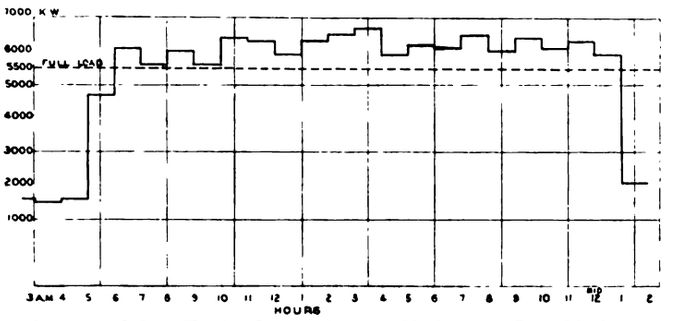
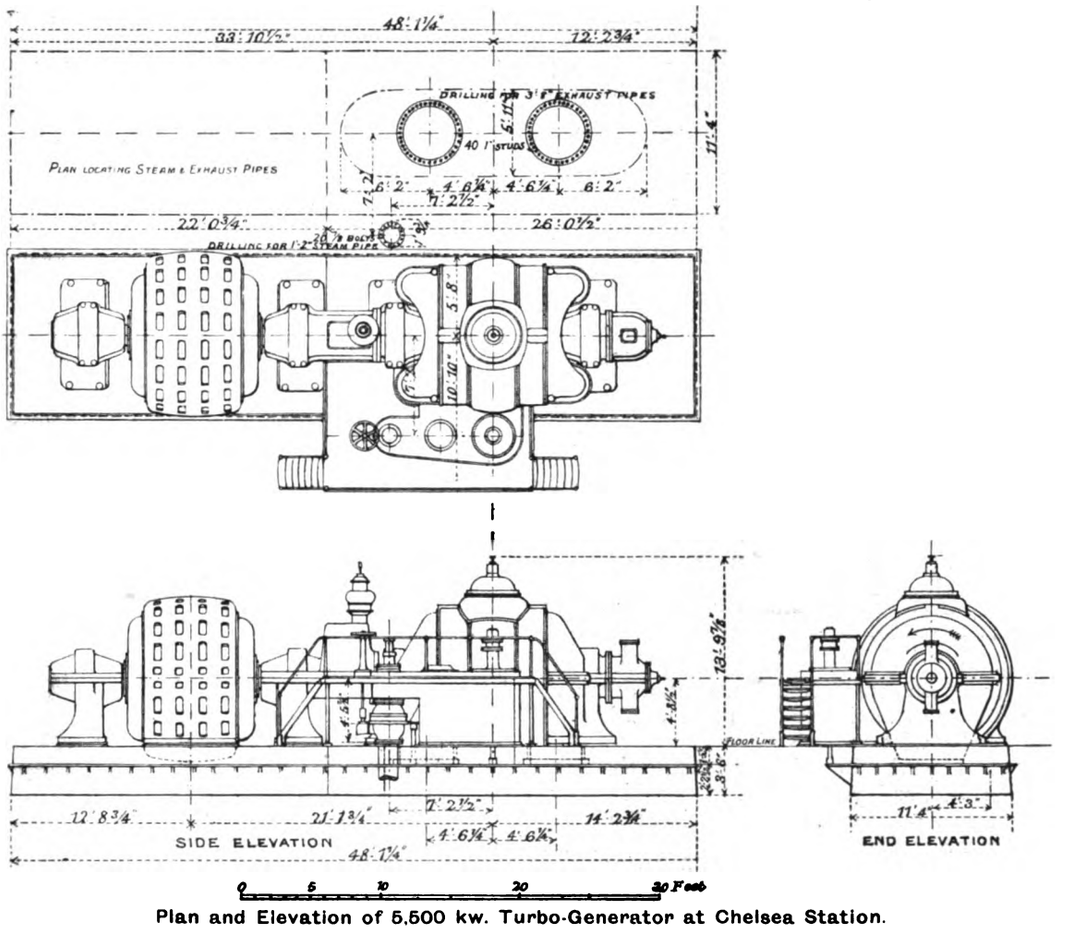
The station is running very smoothly, and by an arrangement for keeping the turbines well warmed up they can be put in service on very short notice as required. The shortest time from the moment of giving the signal from the switchboard gallery, till the additional generator



Output of One Turbo-Generator at Chelsea on Dec. 17, 1907.

is synchronised and switched on to the bus-bars, is three minutes.

The second diagram is instructive as to the load on an individual turbo-generator which ran all day. The record applies to a different day from that dealt with in the first drawing. The capability of these steam turbines and electric generators to stand a moderate overload for a long period is shown by the curve. It will be noted that the set was on overload more or less from 6 a.m. till 1 a.m., and that even after allowing for the underload from 3 a.m. till 5 a.m. and from 1 a.m. till 2 a.m., the total output, 128,300 units, was 97·2 per cent. of full load for the whole twenty-four hours. The maximum load, it will be observed, was 6,700 kw. from 3 p.m. till 4 p.m. this being an overload of fully 21 per cent.



Plan and Elevation of 5,500 kw. Turbo-Generator at Chelsea Station.

ELECTRIC TRACTION IN THE HUDSON TUNNEL, NEW YORK.

The first electric train through the tunnel of the Hudson Companies connecting Hoboken, New Jersey, with Christopher Street, New York, was run on January 4. It is expected that the line between Hoboken and New York will be in operation by March 7. The history of the enterprise dates back to 1874, when an English company commenced the construction of a tunnel between Morton Street and Hoboken. The project was abandoned in 1880, after about 1,200 ft. had been constructed. In 1888 it was revived for a few years, and some 3,000 ft. of brick-lined tunnel were completed. In 1902, the tunnel passed into the hands of the present owners, who projected an extensive system with two pairs of tunnels, one pair between Hoboken and Morton Street, New York, and one pair between Montgomery Street, Jersey City, and Cortlandt Street, New York. The northern tunnels, or those recently completed, are 5,650 ft. in length, with a maximum depth below the river of 97 ft. The southern tubes will be 5,976 ft. in length, and 92 ft. below the river.

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SINGLE-LINE SIGNALS FOR TRAMWAYS.

In our issue of January 2 last appeared an article describing several systems of tramway signalling, including the system which has been installed at several places by Messrs. Brecknell, Munro, and Rogers, of London and Bristol. That firm have now put upon the market a form of signalling which promises to overcome many of the difficulties associated with the older methods of automatic signalling. The principles involved are of the simplest possible character, requiring no mechanism that might break down or become costly and annoying from a maintenance point of view.

This firm have found from long and valuable experience that the use of semaphore arms and solenoids is not only the cause of trouble, and costly in maintenance, but is altogether unnecessary for the purpose. By the use of specially coloured glass, fixed in a certain manner, behind which are mounted electric incandescent lamps of moderate candle power, it is possible to see, even in the brightest sunlight, whether the lamps are lit or not. The whole arrangement, in fact, consists of an ingenious system of lighting and extinguishing incandescent electric lamps.

The system is based chiefly on the use of what are known as magnetic relays (hitherto used to a large extent in telegraphy) in connection with an electric tramway or railway, or, if necessary in connection with a system of traction other than electric, the signalling apparatus being supplied with electricity from an independent source. It should be stated that, if it is desirable to use semaphore arms instead of or in connection with lamps, it is possible to do so without in any way interfering with the simplicity of the principles involved in this arrangement.

The following diagrams are almost self-explanatory: Fig. 1 shows a form of arrangement for one lamp or signal, which could be used to great advantage on many systems where the proper spacing of cars is a serious difficulty. This arrangement consists in forming a momentary contact C at one end of the control on the overhead or like conductor W, which is connected by a wire W^1 to a contact point C^1, which is in turn connected to one end of a magnetic coil M of a magnetic relay composed of a wire coil M, wound in the usual manner round a laminated core B. This magnetic relay is connected through (by preference) two 250-volt lamps, where the voltage is 500, and from thence to the negative side of the supply E. From the negative end of the magnetic coil is a wire W^2 leading to a momentary contact C^2 on the overhead wire W at the other end of the control. An armature A is mounted adjacent to the laminated core B, suitably and permanently connected to the trolley wire as shewn by the arrow T. In operation, the trolley wheel of the car, or, in the case of other than the overhead system, the skate making contact for the fraction of a second at C magnetises the bar B and draws the armature A into contact therewith, and causes a current to pass from the source of supply W down T and hold the armature in contact with the contact C^1, and laminated core B, thus keeping the circuit complete and supplying current for the lamps or the operation of other signalling apparatus. When the car is leaving the control momentary contact is made at C^2, thus momentarily short circuiting the magnetic coil M and demagnetising the core B owing to the fact that the resistance of the wire W^2 is practically nil compared with the electrical resistance of the magnetising coil M of the relay. Hence the result is that the core B is demagnetised, thus releasing the armature A and breaking the contact, first at the point C^1 at a time when there is practically no current flowing. Thus the relay is sparkless in operation; the lamps are extinguished, or in the case of a semaphore, the arm returns to its normal position.

A duplicate of this arrangement provides an excellent system of signalling for single line and loop working. An obvious disadvantage, however, would be that after one car had entered the block, a second car might follow in, and the line cleared by the first car whilst the second car was in the block.

Fig. 2 shews a similar form of arrangement to that shewn in Fig. 1, with the exception that the lamps or signals are in duplicate or in series, one set being at either end of the control. In this arrangement should the lamps or the line be faulty, or should one filament break, none of the lamps would light or be lit, and handworking would have to be resorted to in exactly the same manner as if no signal existed.

Fig. 3 shows the arrangement of Fig. 2 again duplicated for single-line working, the home and distant signal system being adhered to. In the before-described arrangements it will be seen that the condition of the home signal is an absolutely correct index of the condition of the distant signal, and that each is perfectly interlocked, so that the driver of a vehicle can first tell, when approaching the end of the block, whether the line is open or not, and, if not, whether the vehicle in the block is travelling in the same direction as himself or approaching. The method adopted is, that a red light shows that the line is occupied, and the vehicle is approaching. If a green light is showing it means that the line is occupied, and the vehicle is receding. If both red and green are lit together, it means that a vehicle is receding, and a second one has passed the contact approaching, but is still on double track awaiting the arrival of the vehicle in the block and claiming the right to enter.

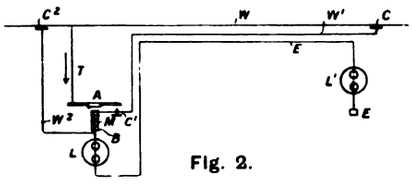


Fig. 2.

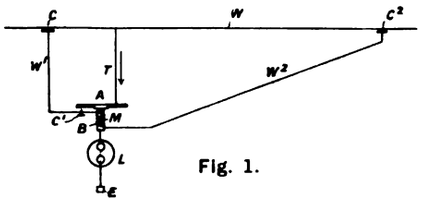
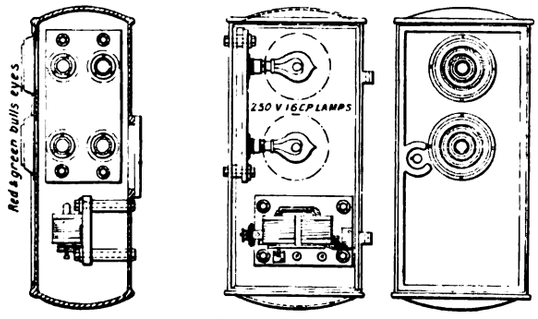


Fig. 1.

So far as can be foreseen this arrangement is such that, with one exception, it would be perfectly safe to rely on these signals for fog working, depending on the principle that the home and distant signals are so interlocked, that before a vehicle enters the single line the man in charge knows by the condition of the home signal, whether the distant signal is set at danger or not. The exception, before mentioned, is that in the event of the electric supply ceasing whilst a vehicle is in the section,



Sectional Elevation. Front Elevation with door removed. Front Elevation.

Fig. 4.—Signal Lamps.

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even momentarily, the armatures of the relays would return to their normal position, and when the current was again turned on to the line the block would be shown to be open and not occupied. One obvious way of overcoming danger from this source would be that, in the event of such an occurrence, the driver in charge of the vehicle in the block should be piloted out of the block by his conductor or other suitable person. This difficulty, however, could be overcome by the introduction of a simple locking arrangement of the armature of the relays, momentarily held off when the lamps were lit.

This system is capable also of coping with a set of circumstances which conceivably may arise, though the probabilities are very much against it. The case supposed is that of a car approaching each end of the block simultaneously, so that each car operates the danger signal at either end of the block at the same moment. The signal lights are so arranged in relation to the overhead contacts that it is impossible for any confusion to arise.

The "on" contact at one end of the block is placed directly abreast of the signal light; the "on" contact at the opposite end of the block is placed some distance, say 40 yds., back from the signal light. Let it be supposed that the motormen are advancing towards the block or single line from opposite ends, and that they both reach their respective "on" contacts at the same instant. The motorman advancing from east to west would have put a danger light in at the west end of the block; simultaneously the motorman advancing from west to east would have put in a danger light at the east end of the block, as both circuits are independent of each other.

The moment before these operations took place no lights were in, and each man considered his road was clear, but an instant afterwards a danger light went in at both ends of the block, but, inasmuch as one of the motormen was a car's length at the very least past the danger light, because he is at the front of the car, and his trolley head is at the back, he does not see it, and, as the light was not in when he passed that point, he does not know the light is in, and goes ahead, infringing no rule.

The motorman at the opposite end, who was also under his contact at the same time, is 40 yds. back from his danger light when it goes in, and, as there is only one rule for these men to remember, he stops and waits on the turn-out for the car (which he knows is approaching him) to come off the straight line. The rule is, no motorman must pass a light, as all lights are danger lights.

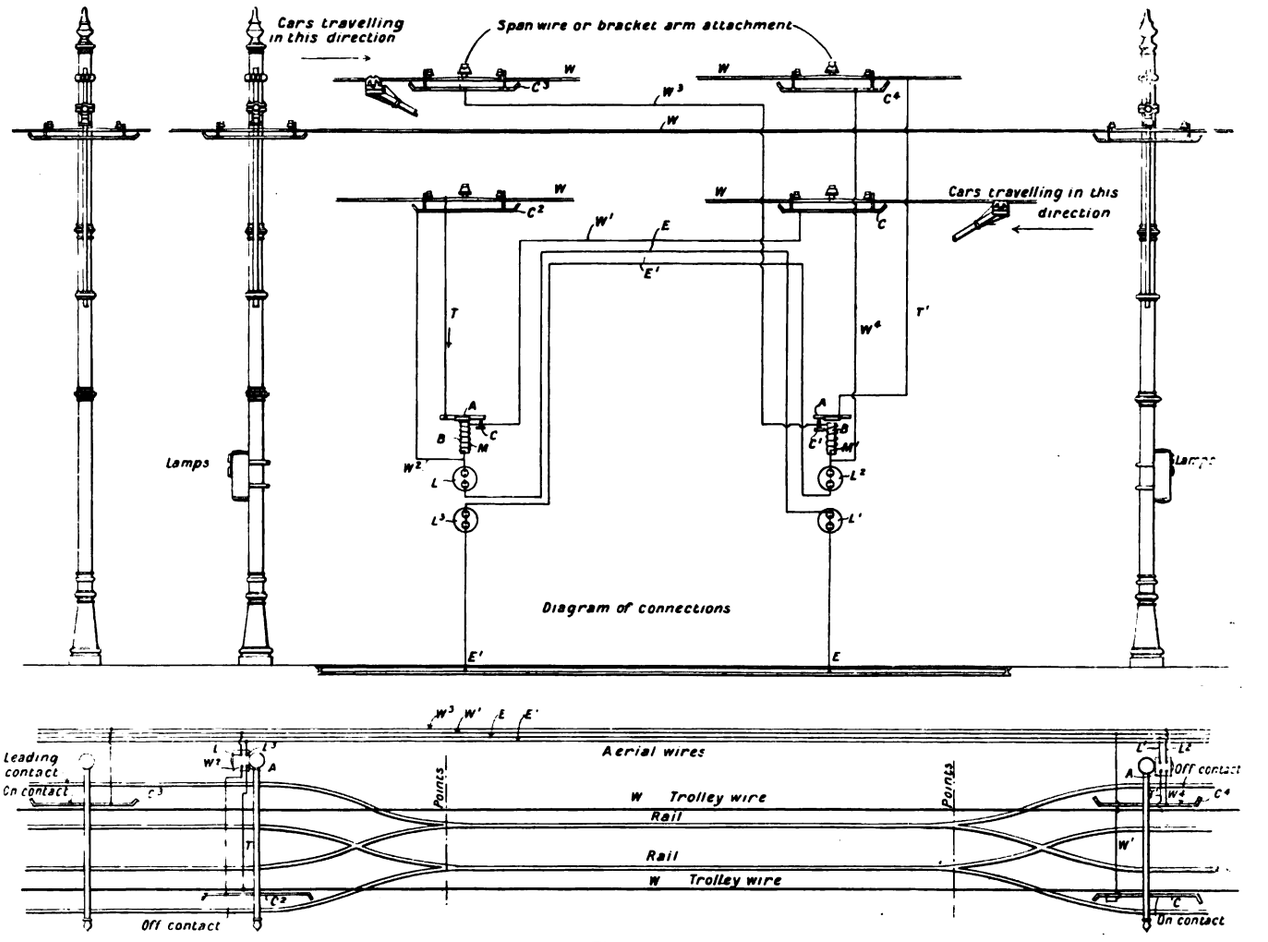

Fig. 3.

On the left-hand side of the plan in Fig. 3, against one of the contacts, are the words "leading contact." This is the "on" contact which is set back from the light. It will be observed that the "on" contact at the other end, which is fitted to the opposite trolley wire, is abreast of the light. Managers of tramways have long been troubled by many difficulties connected with the working of single lines, especially in foggy weather. This arrangement should recommend itself both on account of its simplicity and of the reputation of its manufacturers.

Sandberg Rails for Australia.—Mr. W. G. T. Goodman, engineer of the Municipal Tramways Trust, Adelaide, South Australia, has, after careful consideration, adopted Sandberg's improved steel for all the rails for the Adelaide tramways, about 8,000 tons, to be made by the North Eastern Steel Company.

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THE

Tramway and Railway World

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We shall be pleased to receive at all times articles, papers, notes, and correspondence on subjects of interest to those concerned in the financial administration, construction, or management of tramway and light railway undertakings. Particulars as to the issue of specifications, the progress and completion of contracts for new work, and suggestions for improvements in all branches of tramway enterprise will receive special attention.

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LONDON, FEBRUARY 6, 1908.

The Australasian Tramway Association.

The information published in this issue as to the formation of an Australasian Tramway Association will be productive of sympathetic interest among all tramway men at home. Australia as yet does not possess very many towns of sufficient size to be the owners of large tramway systems, but the colonies there are growing, and several new undertakings have been started within recent years. New Zealand also has several tramway undertakings, and Tasmania has one or two, and in all cases there is good expectation of more to follow. One circumstance which should make the Association of particular value is the great distances which separate many of the tramway towns from one another. These distances are such, that but for the existence of an Association, the managers, engineers, and other officials could have little or no opportunity of meeting. The new body gives an occasion for an annual gathering from the three principal sections of British Australasia, at which subjects of common interest can be discussed, papers read, and information exchanged. It is interesting to observe that the benefits derived from the tramway associations in this country and in the United States were freely cited at the inaugural meeting, and that the subjects discussed embraced some of those which are and have been dealt with by the associations in Great Britain. The advocacy which we have ourselves given to such associations was put forward strongly. As to the papers read, that on brakes, which is given in full in this issue, is of special interest here at the present time. It will be noted that the air brake is extensively used, and finds much favour in Sidney. It is gratifying to see that in the new Association no distinction is made as between tramways worked by companies and those worked by the State and by local authorities. All three were well represented at the meeting. The only matter of regret, to our minds, was that the great Melbourne Tramway Company was not represented. Possibly this arose from the fact that it uses cable traction, while all the other undertakings are for the most part electric. There are, however, many topics of tramway interest quite independent of the kind of motive power used, and we shall be glad to see the Melbourne company sending its officials to future meetings of the Association. We wish the new organisation every possible success.

Capital and New Work.

We recently commented on the exceptionally small number of bills in the present session of Parliament seeking powers to construct tramways. Since then the materials have become available for computing the mileage proposed, and the amount of capital to be raised. Particulars under these heads will be found on another page of this issue, and from these it will be seen that even in proportion to the number of schemes, the length of lines and the capital are very small. The proposals of companies and of local authorities are alike affected. It cannot be averred that this country is already provided with all the tramways and electric railways that it requires. Municipalities, of course, cannot go on extending their lines indefinitely beyond their boundaries, and purely urban wants have been largely supplied. It is true that companies are hindered in interurban schemes by local authorities and by Parliament, but that fact has not altogether paralysed enterprise in the past. The real main cause of the present situation seems to be the difficulty of raising fresh capital. This

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affects both local authorities and companies, and schemes have been postponed pending an improvement in monetary conditions. The same thing is apparent in the sphere of railways. Parliament will not be called on this year to consider any new railway proposals of first-class magnitude, nor even of what may be called second-class importance. So far as the construction of new lines is concerned, the railway companies have called a halt, and are merely marking time. It may be hoped that the recent decline in the bank rate to a more normal level is the forerunner of an improved condition. Much benefit should accrue both to railway and tramway undertakings, if the coming year is marked by a predominance of fine weather. This will help to counteract the present falling tendency in traffic receipts, and another year might show a considerable revival both in tramway and railway promotion.

Underground Railways and Fire.

In various descriptions which have been published in these pages of the underground electric railways of London, we have given prominence to the elaborate precautions which exist to prevent fire from breaking out in the trains, the tunnels, and the stations. Especially in the case of the more recently-equipped lines it may be said that the risk of fire is non-existent, simply because there is nothing which will burn. Many members of the general public, however, are evidently ignorant of the fact, and early in January several letters appeared in various newspapers, based on an incident on a train on the District Railway. A little insulation of some of the lighting wires was fused, some arcing and flashing took place, and a little smoke and smell from melted bitumen arose. There was, however, nothing to catch fire, the wood of the cars being rendered non-combustible by chemical means. Probably on account of the risk of a popular scare, the Board of Trade appointed two of their inspecting officers to enquire into the incident, and doubtless for the same reason the report of these officers was issued with unusual celerity. In fact the publication was only about ten days after the event. This report explained how unnecessary was any alarm, and the officers, departing from the ordinary official lines, expressed their opinion freely against attempts being made by writers in newspapers to create alarm. In more than one direction the Board of Trade have recently been trying to escape from the bonds of red tape, and it is to be hoped they will continue their efforts to render themselves more and more useful to the industrial community.

Rural Tramways.

The scope that exists in this country for rural or interurban tramways is only imperfectly realised. While our large cities and towns are now provided with modern systems of local transport, scarcely a beginning has been made in the work of connecting these towns and the intermediate villages with electric lines. Yet the need for them is keenly felt and, in many instances, there is ample traffic to make an inexpensively constructed electric tramway pay under careful management. The reasons why the field is so largely untouched are various. The increase in tramways has been so rapid in recent years that everyone concerned has been busy with the larger urban installations, and public attention has, as yet, scarcely been directed to the advantages to be derived from the extension of the larger systems to suburban or rural places. Then, too, it has not been so easy as it should be to arrange for the construction of such lines. Private promoters have been discouraged by the difficulty of obtaining powers under reasonable conditions, while the smaller local authorities are not in a position to undertake tramway construction. Such a condition cannot continue indefinitely; and it is clear that either private enterprise must be given the necessary encouragement, or some arrangement be made for the combination of several local authorities for tramway work. Joint boards are not the best machinery for the purpose, but they are better than no machinery at all. A method which has proved quite successful in a few cases where it has been tried, is a union of municipal and private enterprise. In such cases the local authority constructs and owns the tramway, and entrusts its working to a company. It is difficult to understand how any objection can be raised to an arrangement of this kind. Terms mutually satisfactory to all parties should not be difficult of attainment, provided the local authorities are prepared to admit that the investor is entitled to look for a fair return on his money. Hitherto,

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promoters of electric tramways have undoubtedly entertained too sanguine expectations, and have accepted terms that are not being justified by the results obtained. It must, however, now be admitted by any one who has given any attention to the matter that, in the case of tramways where the traffic is comparatively small, financial success can be secured only by careful economy both in capital cost and in regular working. If the country is to be provided with the rural tramways that it needs, this necessity for economy must be recognised by those authorities whose co-operation is sought by tramway promoters.

A Problem in Tramcar Design.

There is at present a great waste of time at stopping places on electric tramways where large numbers of passengers enter or leave the cars. Where large cars are used the delays often amount to two minutes, and where this is frequently repeated the waste so entailed becomes of considerable importance not only to the public but to the tramway owners. Reduce the length of the stops, and the journey times can, of course, be shortened without increase of speed. Greater service can thus be obtained from the rolling stock, while the congestion in the streets will be much reduced. Something can be done by encouraging passengers to alight and enter more quickly; but until use is made of both doors of the cars no great saving of time can be secured. In a recent issue we gave illustrations of a car planned with the object of bringing both platforms into use, and there seems to be no valid objection to urge against the adoption of some such design. To allow the motorman to occupy the whole of the front platform, while contending streams of passengers struggle to enter or leave the car at the rear, is certainly not an ideal arrangement, and should be tolerated only as a temporary arrangement. The problem before the designers of cars is to effect such a change as will permit the car to be emptied and filled at the same time. When the last outgoing passenger has alighted, those who wish to enter should be in their places. This can be arranged if all passengers leave by the front door and all enter at the rear. It must be made possible, of course, for the passengers to alight at the side of the car nearest the footpath, but to effect this ought not to be a problem of insuperable difficulty.

Depreciation

In the discussion of allowance of depreciation in tramways, the rate at which the writing off is done is frequently alluded to in a very loose manner as 5 per cent. or 8 per cent., as the case may be. This may mean 5 per cent. or 8 per cent. written off annually from the book value or a like proportion written off the first cost, or it may mean 5 or 8 per cent. plus an increasing amount, as reckoned on the first cost, is written off every year, so as to bring in the accumulating interest which is being earned on previous sums written off for depreciation and re-invested in the business. Buildings may be treated in the first way, rolling stock in the second, and leasehold property in the third, but it is often difficult to gather which method of writing off is in the mind of a speaker when he refers in a discussion to so much per cent. for depreciation. It would be well if some standard system of dealing with depreciation could be devised. Some years ago the Joint Committee of the Institute of Municipal Treasurers and Accountants, and the Municipal Tramways Association, agreed upon a standard form for tramway accounts that has proved of considerable value to the industry. A like endeavour in respect to depreciation allowance might prove of equal service.

CORRESPONDENCE.

Standard Tramrail Specification.

To the Editor of The Tramway and Railway World.

Sir,—Mr. Howard Smith, in his letter appearing in your December issue, writes a lot but says little.

He appears to have a considerable amount of time on his hands for the consideration of my remarks and finding cause therein for amazement, but he has no time, apparently, to justify his position as Chairman of the Tramrail Sub-Committee by taking into serious consideration a matter which is acknowledged to be one of the most vital importance.

As long ago as June 6 last the Rails Committee referred to Mr. Smith's Sub-Committee certain representations from myself and others as to composition and design of tramrails, with directions that a suitable date should be fixed for discussion.

Mr. Howard Smith objected to these matters being referred to the Sub-Committee until new or more evidence as to the best composition was forthcoming, and he has not yet found a suitable date for discussion.

If Mr. Smith's point is that the British Standards Committee (subsidised out of Public Funds) is to take no initiative in such a matter as that under discussion, then I, for one, do not agree with him.

Yours faithfully,

Stephen Sellon.

36, Victoria Street, S.W.,
January 3, 1908.

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Rail Corrugation.

To the Editor of The Tramway and Railway World.

Sir,—I should like, with your permission, to reply to Mr. Panton's letter in your January issue on the above subject. Mr. Panton is, I think, giving up his first theory. In your November issue he distinctly says that the squaring of the trucks cured corrugations on his line, and without the aid of grinding. I can say, without fear of contradiction, that he has had his rails *scrubbed*, and that they are as bad to-day as they were six months ago. He was quite right in saying the rails were not to blame, as all classes of rails are affected. He mentions the District Railway Company, who have used Sandberg rails. These, he says, have corrugated in three months, the cause being the rails are too hard. He says: Why not deal with the cause? Surely prevention is better than cure. Might I suggest a cause and a positive cure.

Corrugations are only found on the outer rails of slack curves, or on rails not straight in what may be termed a straight track. Does it not follow that, this being so, the cause is not far to seek. The rails on a curve vary in length, and the wheels being fast on the axle can only travel equal distances. Consequently the wheel on the outer or longer rail has to hop, skip, and jump, as it were, to keep up with the inner wheel. This is the primary cause of corrugation, and in my opinion neither flexible, bogie, or radial trucks, or trucks squared and strengthened, will stop the trouble. Why not try a loose wheel? There is no difficulty.

Alfred Ward.

99, Paddington, Liverpool,
January 20, 1908.

REVIEW.

Callender's Slide Rule for Determining the Sizes of Cables.

Some fifty years ago, before army examiners and text books written down to the intelligence of the imbecile had debauched the intellect of our youth, a student had to find out a good many things for himself, greatly to his advantage. The text books he studied did not insult his common-sense by tedious explanations of the obvious, and by endless repetitions; rather, if anything, they credited him with better acquaintance with his subject than he possessed, and his teachers discouraged silly questions. No doubt time was often lost in this way, but, on the whole, the effect was good. For instance, a student of trigonometry would find two formulæ given for the same thing, the easier and more obvious of the two being dismissed with the remark that it was not adapted to logarithmic computation. There was no one to tell him that this meant that it did not break up into factors, involving simple sums and differences of known quantities; that he had to discover for himself, and he was apt to conclude that the simpler formula was preferable. Two days' land-surveying would have changed his opinion, but practical work was not then much in fashion. Our student seldom saw and hardly ever used a table of logarithms; those which were needed in an examination paper were supplied, with the question, by the examiner, a custom of which the examinee highly approved, for the given logarithms almost inevitably gave a clue to the method of solution, and a lad accustomed to find out things for himself was not likely to miss the clue. Still, for want of familiarity with them, a notion grew up, not yet quite extinct in some quarters, that logarithms were somewhat abstruse and transcendental; the student knew that the logarithm of a product was got by adding the logarithms of its factors; knew also the formal proof that it was so; but it seldom occurred to him that the rule was but an extension of the perfectly familiar fact that to multiply two powers of ten together, say a hundred and a thousand, you put as many "noughts" in the answer as there are in the multiplier and multiplicand.

In these days we are impatient even of logarithms; the slide rule adds and subtracts the logarithms without troubling the user with their values, and translates the result into plain figures; it is also accurate enough for ordinary work, and any formula "adapted for logarithmic compilation" can be evaluated by means of it in a minute or so. But even that is not enough; as every trade has its own ready reckoner, so every engineering department must have its own slide rule. There are estimates which it may be troublesome to remember, or to look up, which, if the use of the rule be a limited one, can be allowed for once for all in the position of the fiduciary points, and the multiplication of slides diminishes the risk of error either through forgetting how far the calculation has gone or through mistaking the decimal point. In Messrs. Callender's slide rule the problem is to find the size of cable to transmit so much power such a distance at a certain voltage and with a certain percentage loss. Now, in these conditions the section varies as the load, the percentage loss allowed, and the length of the cable, and inversely as the square of the voltage, giving rise to a formula obviously suited to slide rule calculation. On Callender's rule the yards and volts are printed top and bottom of the same slide, but the scale of volts rises at half the rate, since the square of the volts is involved. The percentage loss is on a slide at right angles to this, and to the kw. slide; and the scale (logarithmic) of sizes runs diagonally across the squared paper so that it may be referred to both sets of scales. This arrangement obviates the awkwardness of a long series of parallel slides. Since the cable may have to carry idle current a supplementary scale for power factor is added, the effect of which is virtually to change the percentage loss allowed, and which is printed lower down on the same vertical slide. Also allowance is made for difference of system of supply when the problem is to find the size of each cable of a two or three-phase system, star or mesh connected, etc. Obviously, if any other of the factors involved were the unknown quantity, the rule could be used to find it. A necessary caution is given that the results are subject to comparison with a table of current densities. If anyone should try to dissipate 50 kw. in a hundred yards of cable at 500 volts, the table would show him the size to use, but the result would not be accurate, for the temperature co-efficient is not allowed for, and the cable would grow most uncomfortably hot. Lastly, there are directions printed on a card at the back, which slides out, telling precisely how the rule should be used. It does not quite sufficently explain why the results come out correctly, but that will be of small importance to most of the users. One may be able to play the piano admirably without any knowledge at all of its internal mechanism.

Tramways and Light Railways Association.—The *Official Circular* for January of this Association contains a notice of the Home Office inquiry to be held on March 3 at the Caxton Hall, Westminster, by Mr. James Swinburne, regarding the draft regulations for the generation, transformation, distribution, and use of electrical energy. Objectors will be heard, and they can appear either in person, or by counsel, solicitor, or agent. The inquiry will be continued from day to day or otherwise. The *Circular* also contains a list of tramway Bills for the Parliamentary Session of 1908, and copies of the Board of Trade reports on the recent tramway accidents at Halifax and Birmingham.

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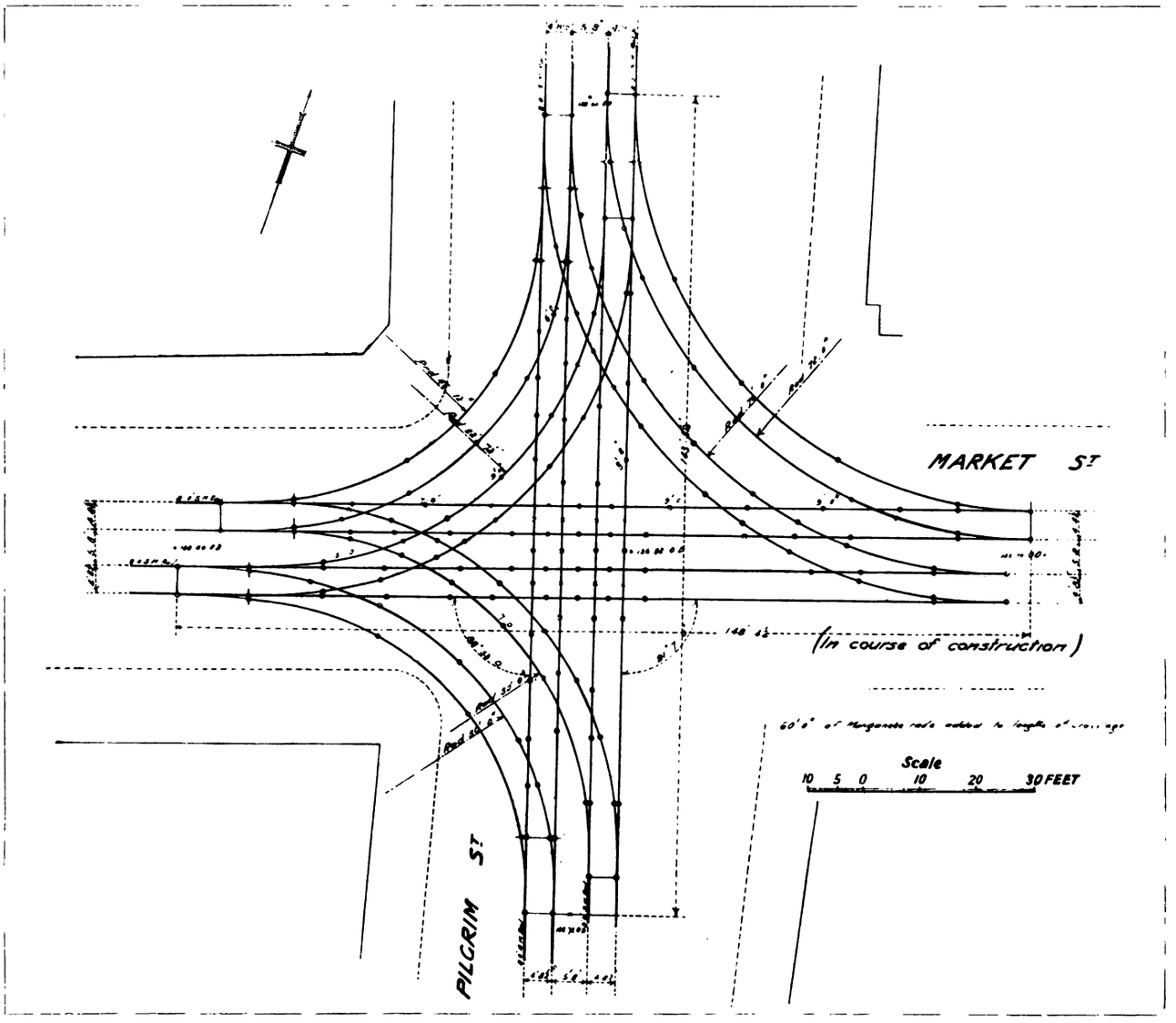
A LARGE TRAMWAY LAY-OUT FOR NEWCASTLE.

A notable gathering of tramway engineers and managers took place in Sheffield on Wednesday, January 29, in response to an invitation by Messrs. Edgar Allen and Company, Limited, Imperial Steel Works, Tinsley, Sheffield, to inspect a large lay-out for Newcastle-on-Tyne, manufactured entirely in their imperial manganese steel. After luncheon at the Royal Victoria Hotel, the party drove to Vulcan Road, Tinsley, where the tramway shops of Edgar Allen and Company, Limited, are situated. On arrival at the works, the visitors were shown round by the directors, who explained the chief features of the lay-out, and also showed the most recent examples of track work, amongst which were special crossings for the United States which will help to balance American work coming into this country. The party likewise inspected points and crossings for several European countries, China, and Japan, for which latter country Messrs. Allen are now completing a large contract.

The length over-all of the Newcastle lay-out is 148 ft. by 143 ft. It is nearly a square, but actually 91·07%. The nearest example for purposes of comparison is afforded by Fizalan Square lay-out, Sheffield, which, however, is about 45 ft. less in one direction, and about 30 ft. in the other, and whereas that junction has curved tracks on two sides only, the Newcastle lay-out contains curved tracks on three sides, forming two 3 Y curves, thus increasing the number of compound castings.

There are 136 pieces in the lay-out, and the total weight of castings is 50 tons. The longest point is 17 ft., and consists of a movable point and two crossings combined; it weighs 16 cwt., while its mate weighs 11 cwt., and carries one crossing at the toe end. The average length of the points is 12 ft. with 9 ft. tongues, weighing 15½ cwt. per pair. There are 5 large 3-way crossings, averaging 12 cwt. each. The centre star crossings are of the ordinary type, with one exception, which has legs about 10 ft. long on each side, so as to connect up two sides of the junction; this weighs 9 cwt.

The total number fo crossings is 30, and they vary in length from 9 ft. to 14 ft., and in weight from 5½ cwt. to 15 cwt. each. There are 63 rails, all of cast manganese steel. The average length is 15 ft., the lengths being regulated by the necessary joints, but where possible 20 ft. rails are used, so that Newcastle now holds the record for the longest cast rails. All the rails are cast straight and curved to the radius required. One special feature is that all the straight rails are of



Plan of Tramway Junction for Newcastle.

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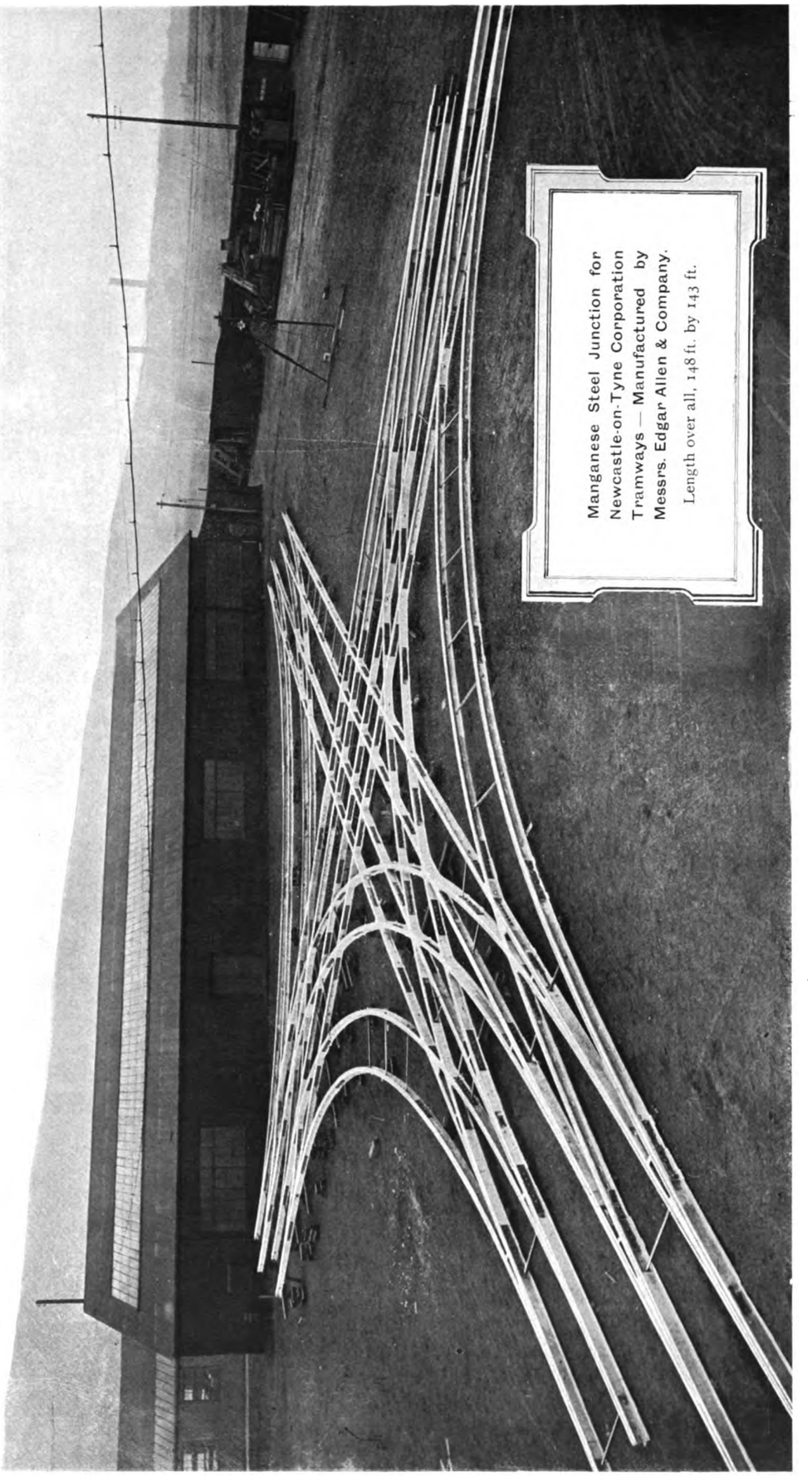

Manganese Steel Junction for Newcastle-on-Tyne Corporation Tramways — Manufactured by Messrs. Edgar Allen & Company.

Length over all, 148 ft. by 143 ft.

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manganese steel, and we believe that this is the first time in which these have been used throughout a large junction of this class.

The chief aim of the city engineer of Newcastle was to avoid joints, and this has been done to an unusual extent, but the manufacturers are now prepared still further to reduce the number of joints on a future occasion.

The chief features of the work may be summarised thus: (1.) Entirely manganese steel. (2.) Compound work. (3.) Extra long crossings, designed to couple to each other, which, with one exception, do connect to each other, and to the points on the inner of the three Y curves. (4.) Each inside curve is coupled to each other, and also to the centre crossings, and it is intended to put the job together on spare land and haul it bodily into position, leaving the outer curve rails to be coupled afterwards. (5.) This lay-out has been constructed to the gradients of the street.

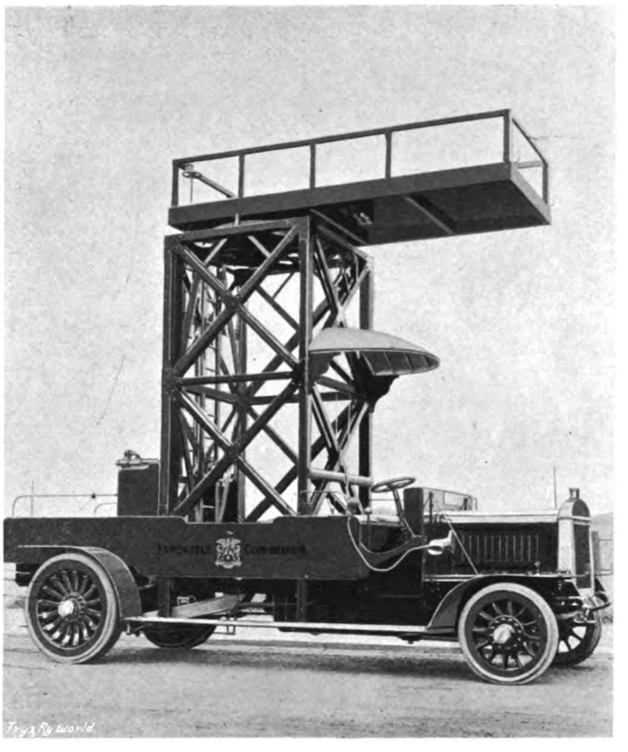
A capital idea both of the general appearance and of the details of this fine piece of work may be obtained from the accompanying photographic view and drawing. Messrs. Allen are certainly to be congratulated on their continued and growing success in the manufacture of special track work, and no greater testimony can be had to the quality of the article than that it is able to force its way through the tariff walls set up by foreign countries for the benefit of their own manufacturers.

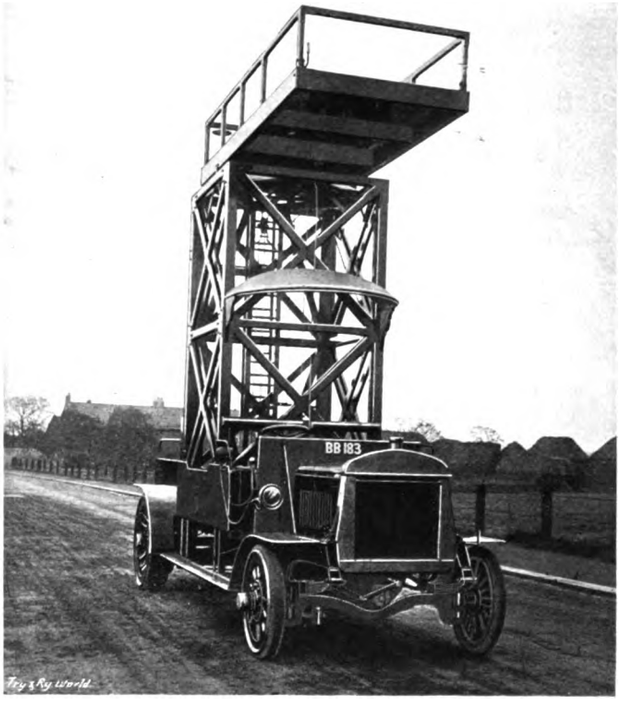
Midland Railway Electrification.—A trial train has been run over the part of the Heysham and Morecambe branch of the Midland Railway on which the electric equipment has been completed. This is the section from Heysham to Torrisholme junction. The run was reported to be successful, and it marks the first trial of a train driven on the alternating current single-phase system in this country.

The L. and N. W. Electric Railway.—The London and North Western Railway Company have informed the Watford Urban District Council that owing to the unfavourable state of the money market they do not feel justified in attempting at the present time to raise the large capital which would be required to construct the authorised Euston to Watford electric railway, but that they will certainly do so at a more favourable time.

A NEWCASTLE MOTOR TOWER WAGON.

The motor tower wagon here illustrated, built by the Newcastle Corporation tramways department, has been designed for the purpose of meeting requirements both for overhead construction and maintenance work, and so far has been found suitable to every purpose in connection with the work the wagon was intended for. Various improvements have been introduced, so that those who have this class of work in hand may have every facility to enable them to deal expeditiously with every detail required. On the front of the wagon, under the driver's seat, provision has been made for carrying all the tools and spare parts that may be necessary to deal with any part of the engine, steering, or brake gear, whilst a canopy has been erected immediately over the driver's seat to give protection from rain, or from anything that may accidentally fall from the platform above. At the rear end sufficient space has been provided to accommodate a work bench with an up-to-date vice for fitters' work, and ample accommodation has been provided for carrying all the tools necessary to deal with any kind of breakdown to the overhead system. The lockers, etc., are water-tight, so that all materials carried are not in any way exposed to the weather. Seating accommodation has been provided for nine men, including the driver.





Motor Tower Wagon with Ryknield Chassis.—Newcastle Tramways.

The tower, which is in the centre of the chassis, is constructed of two cages (inner and outer), and on the top of the inner cage is attached a revolving platform, which is so arranged that it may be moved to any desired position 6 ft. from the outer sides of the cage from which it is suspended. The mechanical arrangements are so devised as to render the revolving operations easy and effective, being worked on the gear and pinion principle. The outer case of the tower has been so constructed as to meet the heavy strains that these vehicles are at all times called upon to stand, and at the same time due consideration has been given to reducing the weight to a minimum. The inner cage is so constructed and suspended that

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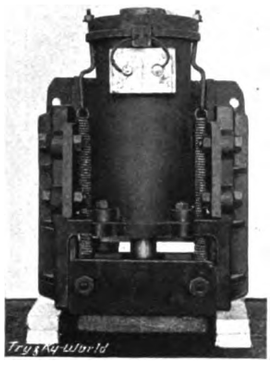
it may be raised to a height of 6 ft. above the outer cage, and a rack and pawl arrangement has been fixed in such a manner as to prevent a possibility of the cage dropping downwards. The winding gear is of the double worm type, the spindle of which is extended to the rear end of the wagon, the operator thus being clear of all passing traffic. The time required to raise the cage to a height of 6 ft. is one minute.

The chassis is of the Ryknield omnibus type, fitted with a 40 H.P. 4-cylinder engine, giving a speed up to 20 miles per hour. There are four forward speeds and reverse gear, and the vehicle is capable of taking all hills on top gear. The cooling is effected by a special radiator supplied by Brewtnall, of Newcastle.

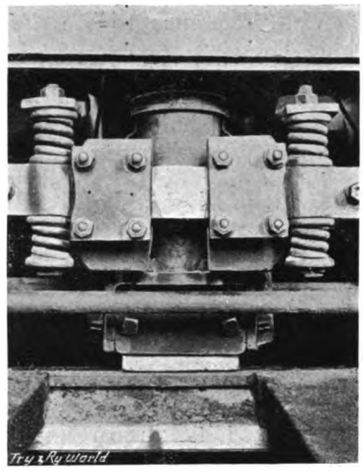
A NEW RAIL GRINDER.

This apparatus, which is manufactured by Messrs. Brecknell, Munro, and Rogers, London, has been designed so that it may be attached to existing truck frames, and can be used by passenger cars in ordinary service, or, if preferred, may be fixed to watering cars.



Rear View.

It will be seen from the photographs reproduced that it consists of a main frame, bolted to the truck side frame, and carrying a solenoid, the plunger of which goes through the bottom and carries, or is connected to, a block-holder, by means of which a carborundum block is held in position, and is lifted or depressed as the guide is moved up or down by the movements of the solenoid. The photograph also shows the vertical springs, which are used to pull up the block-holder when the solenoid is open-circuited. This apparatus is duplicated on the other side of the truck, and is connected to the line in the manner shown by the drawing. From this it will be seen that the whole apparatus is controlled by one small switch, fitted in some convenient position on the dash-plate of the car. A tapping is taken from some convenient point in the trolley circuit to one end of this switch, a cable is run from the other end of the switch to one of the solenoids, and from the negative side of that solenoid to the other solenoid, this second solenoid being earthed to the truck frame, so that



Front View.

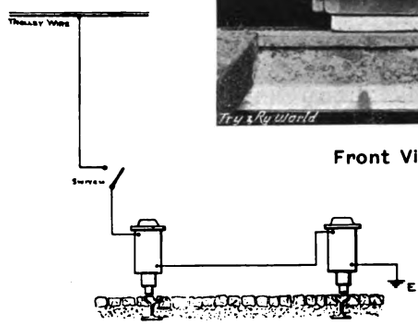
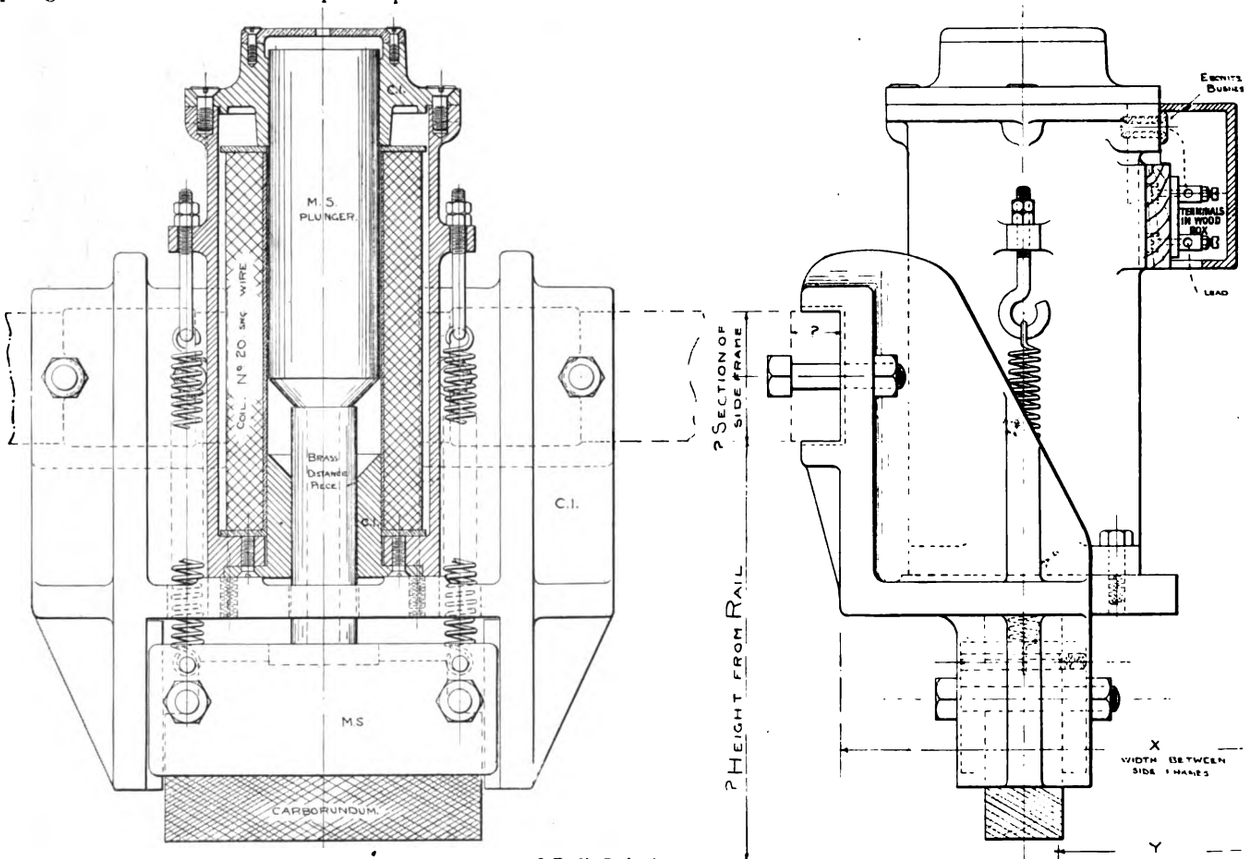


Diagram Showing Application to Rails.

there are two solenoids in series controlled by a switch on the dash-plate. A discharge resistance is fitted, forming a parallel circuit to earth, for the protection of the coils in the solenoids. The total resistance of this circuit is such that a current of about



Elevations of Rail Grinder.

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2 amperes is all that is needed to operate the mechanism, and each carborundum block is held down upon the rail with a pressure equal to 150 lb. dead weight as long as the solenoids are in circuit. Immediately the switch is opened the springs before referred to lift the blocks off the rails.

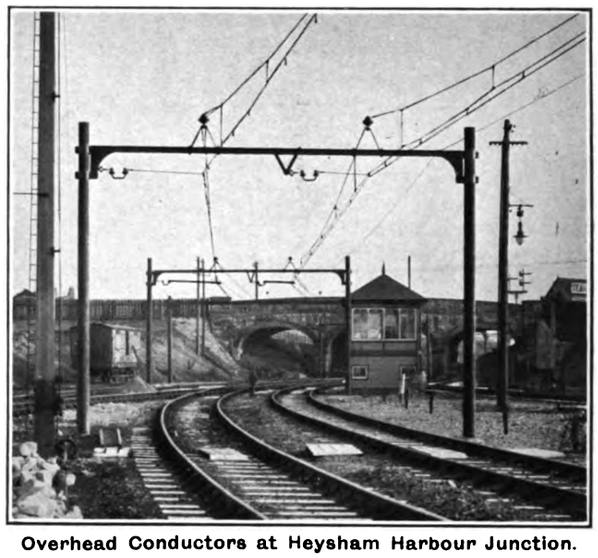
Suitable provision is made to compensate for the lowering of the truck due to the wearing of the wheel tyres.

With reference to the life of these carborundum blocks, it is well known that, when used in the ordinary way for grinding out corrugations, they have a very short life, and form a material item in the expense attending the employment of such apparatus, but, with this invention, the even and comparatively light pressure which is found to be satisfactory in operation, permits of a much-increased life, and it is a feature that with this apparatus a considerably greater amount of work can be done with a carborundum block than might be supposed. The rapidity with which this work is done is also a good point. The explanation probably lies in the fact that the pressure between the block and the rail is unaltered by the oscillations of the truck, and is constant. It has, therefore, been possible gradually to reduce the pressure on the rail until the best working pressure has been ascertained.

These grinders have already been adopted with great success in Cardiff, and it is the intention of Mr. Ellis, the electrical engineer and manager, to increase the number so that there will be one set for operating on each route.

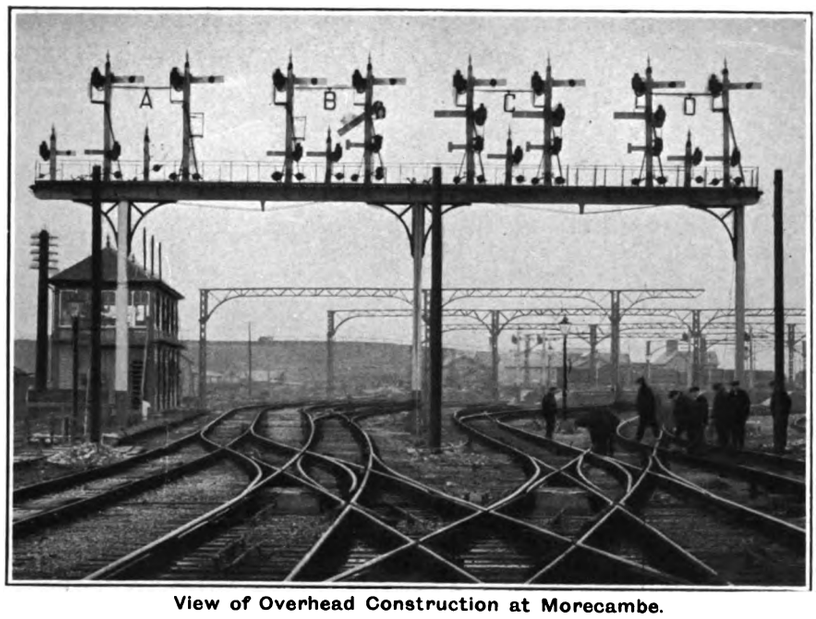
ELECTRIFICATION OF RAILWAYS.

Professor Gisbert Kapp, Birmingham, lectured at the Royal Institution, London, on January 18 and 25, on the electrification of railways. In his first lecture he traced the history of the subject. In describing the various systems, Mr. Kapp said that for main lines of railway, high-tension alternating current working is the only possible system. The countries in which water power is available on a large scale for producing electric energy are Italy, Switzerland, and Sweden. The Italian Government has set aside nearly £3,000,000 for the electrification of railways. The total route mileage embraced in the present programme is 247, equal to 337 miles of track: 3,000-volt, three-phase, 15-cycle current will be used, and the pressure on the feeders will be 13,000, 20,000, and 25,000 volts, according to distance. In reference to Switzerland, 500,000 H.P. will be required for all the Swiss railways. Regarding Sweden, experiments have been carried on for two or three years under the auspices of the Swedish Government. Over 50,000 H.P. from waterfalls is available in southern Sweden. The pressure on the feeders will be 50,000 volts, and on trolley wire 15,000 volts. The lines proposed to be electrified measure 1,380 miles of route, or 2,800 miles of single track. The cost of an 80,000 H.P. generating plant is put at £1,540,000, while feeders, sub-stations, and equipment come to £2,620,000.



Overhead Conductors at Heysham Harbour Junction.

Dr. Kapp opened his second lecture by describing recent developments in continuous-current traction for railways. Dealing afterwards with the single-phase system, Dr. Kapp spoke of the two English examples of this system, which will soon be complete. In the case of the Victoria to London Bridge section of the Brighton Railway, the trains will consist of three coaches, of which the first and last will be motor coaches, each fitted with four 115 H.P. motors. The coaches are 60 ft. long and 9 ft. wide. They rest on two trucks, with 8 ft. wheel-base, and 41 ft. between king pins. The maximum speed will be 42 miles per hour, and the seating capacity 188 passengers. The weight of the empty train is 136 tons. The normal acceleration will be 1·24 ft. per second per second, and the maximum 2 ft. per second per second. It is expected that the consumption of energy per ton mile, exclusive of lighting, will be 79 watt-hours. The voltage will be 6,700, and the trolley wire ½ in. diameter with catenary suspension, the hangers being 9 ft. apart. The second example is on the Midland Railway, where 9 miles of double track have been electrified between Lancaster, Heysham, and Morecambe. The trolley wire is suspended by double catenaries on the Siemens principle, and the rolling stock is being supplied partly by the Westinghouse Company, and partly by Messrs. Siemens. The pressure adopted is 6,000 volts, the frequency being 50.



View of Overhead Construction at Morecambe.

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THE PEACOCK BRAKE.

Whilst engineers have pursued with unabated zeal their search for a brake which shall be independent alike of the rotation of the wheels, of the trolley wire, and of the human element, the device known, after the name of its inventor, as the "Peacock brake," has steadily and unobtrusively crept into favour. In the United Kingdom alone over 1,200 cars have been fitted with it since May, 1905, and as the sales have rather more than doubled in each succeeding year (close upon 700 cars having been fitted in 1907) its progress must not only be considered gratifying to its makers, but convincing to those who have as yet hesitated to adopt it. Yet when the radical changes which have occurred in the transition from horse-drawn to electrically-propelled vehicles in respect to speed, weight of cars, and steepness of gradients are considered, one recalls Col. Yorke's report on the Highgate accident in June, 1906, and wonders why it is that engineers and tramway managers have not been even quicker to discard the old horse car contrivance which has "all the unmechanical features which are characteristic of most tramway hand brakes."

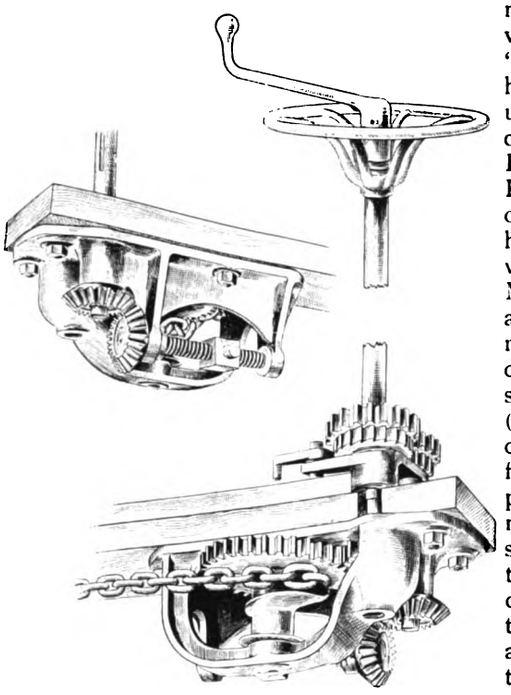

Fig. 1.

Perhaps their comparative inaction is attributable to a very natural desire to wait until the two Brake Committees shall have issued their reports before incurring the expense involved in the change. There is, of course, a feeling in some quarters that salvation lies in the total abolition of wheel brakes, but whilst this opinion is held by some whose opinion cannot be disregarded, there are others who do not hesitate to adopt the views of Col. Yorke, who says: "It seems to me that the track brake can at its best only be regarded as a supplementary to the wheel brakes. It is by means of the adhesion of the wheels to the rails that the propelling and accelerating forces are made to act upon the car, and it is through the same agency, when properly utilised by means of mechanically-designed wheel brakes, that the greatest amount of retardation can be obtained. Track brakes should supplement, but not supplant the wheel brakes."

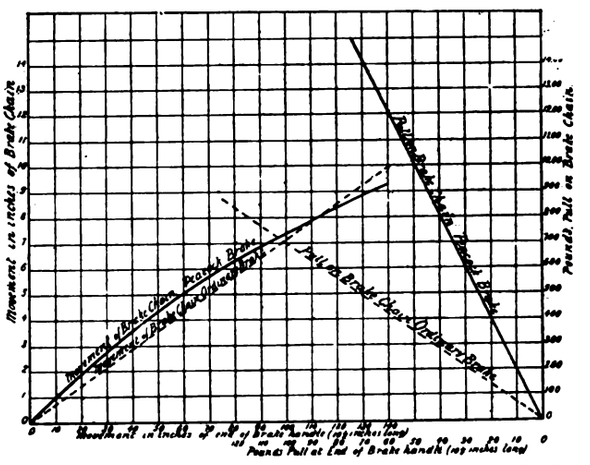

Fig. 4.—Comparison between Peacock and Ordinary Brakes.

Pull on and Travel of Brake Chain.

The Peacock brake is so well known that no description of it nor repetition of its claims to merit are here necessary. Its action is, moreover, so simple that the accompanying illustrations are quite sufficient to indicate its essential features, should any of our readers happen to be unacquainted with it. Fig. 2 shows the type of rigging used for operating wheel brakes only. Fig. 1 depicts a type largely used where wheel brakes and hand-applied track brakes are used in combination. Fig. 3 illustrates the eccentric drum upon which the chain is wound, and Fig. 4 compares diagrammatically the Peacock and ordinary brake gear in respect to pull on and travel of brake chain.

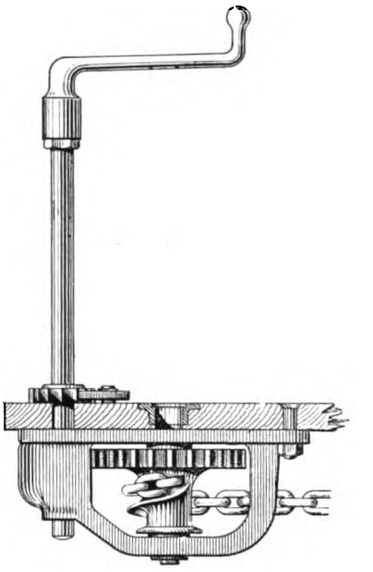

Fig. 2.

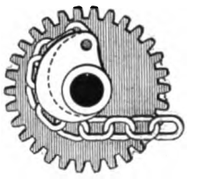

Fig. 3.

Although Peacock brakes are made in a variety of sizes, two have been found sufficient for general purposes. Of these we append the following particulars:

Name of drum.	Frame.	Gear ratio.	Chain wound on large part of drum.	Chain wound on small part of drum.	Total chain wound on drum.	Adapted to.
			in.	in.	in.	
A	A—B	14-34	8½	15½	24	Single truck car.
B	A—B	14-34	11	15	26	Single or double under 20 tons.

Amongst the principal users in this country may be mentioned the Corporation of Birmingham (152 cars); Salford Corporation (in use, or specified for, 59 cars); Hastings Tramways (65 cars); National Electric Construction Company (various tramways, 84 cars); Croydon Corporation (27 cars); Sheffield, Newcastle, Nottingham, Portsmouth, and West Ham Corporations (15 to 21 cars each). To this list may be added as worthy of note Johannesburg Corporation (115 cars); Calcutta Tramways (31 cars); and Bombay Tramways (25 cars).

Over 15,000 Peacock brakes are reported to be now in use on more than 700 tramways in all parts of the world.

Electric Railway Development in Italy.—The Italian Government have assigned £2,700,000 for electric traction on various railways having steep gradients and long tunnels. A company has obtained a concession for the construction of an electric railway between Rome and Naples, and another company proposes to build 100 km. of narrow-gauge electric railways across the Dolomite Alps.

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TRAMWAY TO THE "CIMETERO MONUMENTALE" OF MILAN.

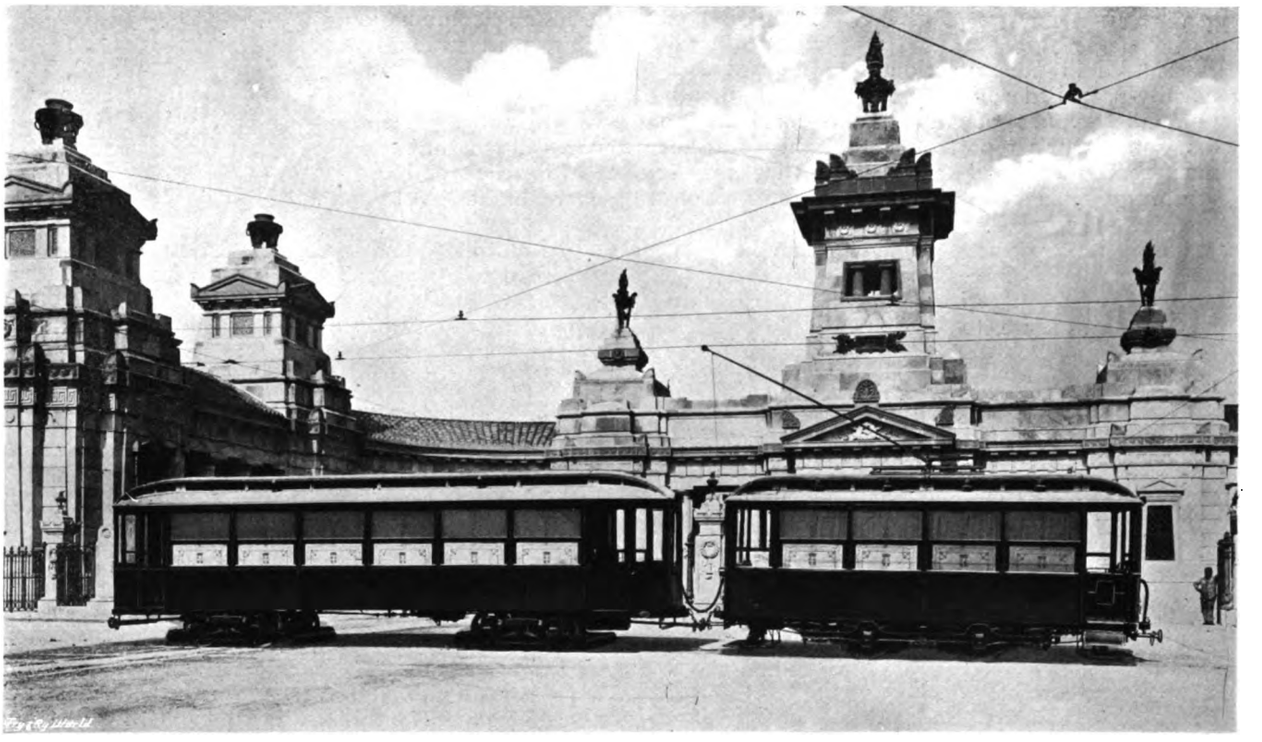
In this country our towns and cities are allowed to expand without the slightest attempt at regulation by any competent authority. The result is that suburban districts are usually built without provision for main thoroughfares, and the congestion of the central districts is constantly repeated in the suburban sections. On the continent, this policy of *laissez faire* is rightly regarded as too irrational for toleration. There a careful study is constantly made by qualified officials of plans which should be followed in suburban extensions. These plans, when finally adopted, are enforced on owners of property, who are thus required to subordinate their individual action to the well-being of the whole community.

Station at Porto Romana.

In Italy more attention appears to be paid to this matter than in many other countries, and the authorities extend their supervision more rigorously to other details affecting sanitation and hygiene. An important department of the public work is that which deals with the cemeteries, and it is probable that nowhere else has the system of burial been more carefully organised. The problem was first approached in Milan many years ago, when it was decided to make provision for one cemetery at a convenient distance from the city, the ultimate object being the closing of all the older cemeteries in various parts of the city. The construction of the new cemetery was begun in 1889, and the first interments were made in 1895.

The new cemetery is situated to the north of the city, in the district of Musocco, and is known as the *Cimetero Monumentale*. When deciding upon the construction of so large a cemetery at a distance of several miles from the city, the Corporation did not neglect to supply suitable means of access to it. As Milan was already provided with an electric tramway system it was suggested that an extension should be constructed to the new cemetery, and this project was ultimately carried out. The organization of a special service, which has since been effected, was described in a publication issued recently by Francesco Minorini, chief engineer of the Department of Public Works, which would repay a study by the authorities of British municipalities. We are indebted to that gentleman for a copy of this publication, and for numerous illustrations, some of which accompany this notice.

The mortuary line had its original city terminus in the Via Bramante, just on the outskirts of the city, where a special station has been constructed, and where the funeral processions from various parts of the city converge. The bodies are there removed from the hearses, and are placed in the funeral cars of the tramway for transportation to the suburban cemetery. The route from the suburban station to the Monumental Cemetery follows the highway, but the greater part of the line is laid on its own right-of-way, and is not used by ordinary traffic. The speed is low, and the track construction is of a light railway character, but of standard guage. A rail, weighing only 30 lb. per yard of a T section, has been laid on oak ties, 6 in. by



Funeral Train at the Cemetery at Musocco.

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8 in. by 8 ft., placed at a distance of 32 in. The overhead construction is of the bracket arm type, and presents no special feature.

The rolling stock has been specially designed, several types of cars being provided. Each funeral train consists of a motor car and a trail car. The motor cars are of the single truck type, have three compartments, and are finished in walnut and teak. Each motor car has space for 44 passengers, while the trail cars carry 40 passengers. The windows are provided with frosted glass. The electrical equipment of the motor cars consists of two Thomson-Houston motors of 37 horse-power each, and beside the ordinary hand brake, the cars are furnished with compound compressed air brakes, with a compressor on the axles. Electric heaters are placed beneath the seats. The trail cars are mounted on two four-wheel bogies. These cars are also provided with compressed air brakes.

The energy for the cars is provided by the Italian Edison Electricity Company, which supplies the power for working the Milan tramway system, as well as for lighting.

A new funeral station has recently been completed near the Porto Romana, which is on the off side of the city, opposite to the original station in the Via Bramante. Elaborate buildings have been erected, and there are convenient waiting rooms for persons who, arriving by carriages to attend funerals, await the departure of the funeral trains. Adjacent to this station is a large car depot in which the trains are made up, and from which they proceed to the station platform.

The rolling stock used in connection with the new station is of somewhat different design from the older cars. The motor cars are of the single truck type, and are about 22 ft. in length, being divided into three compartments, one being reserved for the casket, and two for persons accompanying it. There are also double bogie trail cars which can be attached to the motor car if required.

LONDON COUNTY COUNCIL TRAMWAY MATTERS.

The London County Council resumed their weekly meetings after the Christmas recess on January 21.

Proposed Tramway Abandoned.

On the proposal of the Highways Committee, it was agreed to rescind resolutions approving estimates and sanctioning expenditure for the construction of a tramway in Blackheath Road to connect the tramways in Deptford High Street with those in South Street, Greenwich. The object of this junction line had been to provide alternative routes for the services from London to Greenwich, *via* Greenwich Road, and from London to Catford, *via* Lewisham High Road. The reason for abandoning the project was that the Greenwich Borough Council, although repeated efforts had been made, had refused its consent to the construction of the line.

Greenwich Power-Station.

The Committee reported that the two chimneys for the second portion of the Greenwich generating station were erected to a height of 204 feet, and operations on them had been suspended pending the settlement of the questions as to the working of the station in its relation to the Royal Observatory. The height originally intended was 272 feet, and the cost was estimated at £28,000. The actual cost so far had been £23,674. The present height would not be increased, but some further work was necessary to complete the chimneys at an estimated cost of £2,080. It was agreed that this completion should be carried out by the Works Committee.

Contract for Car Traverser.

During the recess the Committee had accepted a tender by Appleby's, Limited, at £513 10s., for the supply of a car traverser for the central car repair depot. It was also arranged that the contractors should be allowed to sub-let to the undermentioned firms the following portions of the work: (1) W. Beardmore and Company, steel castings; (2) Frodingham Iron and Steel Company, steel plates, bars, angles, etc.; (3) Hadfield's Steel Foundry Company, axles, wheel centres, and tyres. Tenders had been invited from nine selected firms, but only two offers were received, the other one being from Heenan and Froude at £580.

Draught Screens for Cars.

On this subject it was pointed out that the Council at present possessed, or had on order, 1,000 double-deck cars, of which 911 were provided with roof covers. Of these 423 had been fitted with a type of cover which did not entirely exclude draughts, and it was not being adopted for new cars. An efficient screen had been devised, which it was proposed should be fitted to the cars requiring it as soon as possible. The cost was estimated at £10 a car, of which it was proposed to charge £8 to capital account and £2 to revenue. It would be possible to complete the alterations on 50 of the cars during the current financial year, and it was recommended that the work should be done by the tramways department.

The recommendations were agreed to.

Track Insulators and Cables.

The tender of Buller's, Limited, for the supply of 2,000 track insulators at 3s. 5½d. each, and that of Callender's Cable Company, amounting to £800, for the supply of two miles of jumper cable, had been accepted by the Committee. The expenditure would be charged to revenue account.

Harrow Road and Paddington Tramways.

In reference to the recent resolution of the Council to purchase the portion of this undertaking which is within the county of London, the Committee reported that the Metropolitan Electric Tramways, Limited, had written to the Board of Trade urging the Board to withhold their consent to the proposed purchase, on the ground that the lines would be rendered unworkable. In the course of correspondence, the Board of Trade intimated that it was incumbent upon them before approving of the service of a notice of purchase on the company to be satisfied that the interests of the public would not suffer. A reply to this was sent on behalf of the Council, stating that they would be prepared to come to any reasonable agreement for dealing with the matter, either by the Council working the tramways and arranging for mutual running powers, or by leasing the lines to the outside tramway authority. Finally the Board of Trade on December 18 signified its approval of the proposed service of notice on the company, and the notice was served on December 21. The Committee recommended, and it was agreed, that negotiations be entered into, and all necessary steps taken in connection with the arbitration (if any), with reference to the purchase of the lines.

Street Improvements.

In reference to the construction of tramways from Hammersmith to Harlesden and later on from Hammersmith to Putney, the Improvements Committee presented a long report in regard to the cost of widening Hammersmith Broadway under the Council's Act of 1903. The widening was being carried out by Hammersmith Borough Council, and it was now proposed that the County Council should sanction expenditure not exceeding £30,000 as their share of the cost, half of which should be charged to the tramways account.

The same Committee recommended acceptance of a tender by G. Wimpey and Company at £6,393 for paving works for street widenings connected with the construction of tramways from Hammersmith to Harlesden. Messrs. Wimpey have already been awarded a contract for the tramway construction itself at £32,685. The tenders for the paving works were presented to the Council along with those for the tramway construction, on December 17 last, but decision in regard to the paving works contract had been deferred.

Consideration of these matters was postponed, but the proposals were adopted at the meeting on Jan. 28.

Medical Examination of Motormen.

Replying to questions,

Mr. W. W. Thompson, chairman of the Highways Committee, promised to inquire into the allegation that motormen were medically examined after coming off their cars. The doctors carrying out the examinations were doing their best to meet the wishes of the men and to get them passed. It was hoped that in each case one examination would be sufficient.

Contract for Slot Rails, etc.

At a meeting of the Council on January 28, it was agreed, on the recommendation of the Highways Committee, to accept a tender by the Frodingham Iron and Steel Company, for the supply of 500 tons of steel slot rails and 190 tons of conductor rails required for the reconstruction of the Caledonian Road and Seven Sisters Road tramways. The amount of the tender was £5,654. The only other complete tender received was that of Walter Scott, Limited, at £6,490. Steel, Peech and Tozer had tendered for the slot rails only at £4,462 10s. The chief engineer's estimate for both lots was £5,622 10s The amount of the successful tender included £650 for contingencies.

Highgate Hill Light Railways Order.

It was intimated that the Highgate Hill Tramways Company had withdrawn their application for a Light Railway Order for the construction of additional lines in London and Middlesex.

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THE AUSTRALASIAN TRAMWAY OFFICERS' ASSOCIATION.

In a recent issue we briefly referred to the formation of the Australasian Tramway Officers' Association. We have now received a copy of the official report of the inaugural meeting, which was held in Sydney, New South Wales, on November 7-9 last. The meeting was called by the officers of the New South Wales tramways for the purpose of forming the Association. Mr. John Kneeshaw, tramway superintendent, New South Wales, was called to the chair, and the others present included Mr. O. W. Brain, M.Inst.E.E., electrical engineer, New South Wales; Mr. G. R. Cowdery, A.M.Inst.C.E., tramway engineer, New South Wales; Mr. B. Deakin, M.Inst.M.E., M.Inst.E.E., engineer and general manager, Ballarat and Bendigo, Victoria; Mr. W. G. T. Goodman, M.Inst.C.E., M.Inst.E.E., M.Amer.Inst.E.E., engineer, Municipal Tramways Trust, Adelaide, South Australia; Mr. A. C. Parker, general manager, Hobart tramways, Tasmania; Mr. W. H. Stanley, manager, Kalgoorlie tramways, Western Australia; Mr. T. P. Strickland, B.E.M.Sc., A.Amer.Inst.E.E., principal assistant electrical engineer, New South Wales; Mr. F. Thompson, secretary, Christchurch Tramway Board, New Zealand. The other foundation members of the Association are Mr. J. S. Badger, manager and chief engineer, Brisbane tramways, Queensland; Mr. J. J. Bodley, general manager, Municipal Tramways Trust, Adelaide, South Australia; Mr. A. Mitchell, manager and engineer, Fremantle tramways, Western Australia; Mr. S. Richardson, M.Inst.E.E., tramways and electrical engineer, Wellington Corporation tramways, New Zealand; Mr. H. J. Somerset, manager and engineer, Perth tramways, Western Australia; Mr. E. E. Stark, engineer, Dunedin tramways, New Zealand; Mr. J. J. Walklate, general manager, Auckland tramways, New Zealand.

Mr. Kneeshaw gave the meeting some particulars of the arrangements which had been carried out for the formation of the Association, and he read two leading articles from The Tramway and Railway World, of August 31 and September 21 last, on the advantages of such Associations to those engaged in the operation of tramways. Mr. Goodman, who moved that the Association be formed, said that the extracts from The Tramway and Railway World showed the very valuable work which was being carried out by the Municipal Tramways Association in England, and they all knew the exceedingly good work that had been done by the Tramway Association in America. The time was now ripe for an Australasian Tramway Officers' Association. The resolution was unanimously adopted, and the members afterwards inspected the Waverley tramway depot, where a demonstration was given of the process of thermit welding.

On the following day, November 8, Mr. Goodman handed in a copy of The Tramway and Railway World containing an account of the Municipal Tramway Conference held in Manchester in the preceding September. The meeting then proceeded to draft a constitution and by-laws. The following are the objects set out in the constitution:

"(*a*) The acquisition of experimental, statistical, and scientific knowledge relating to the construction and operation of tramways.

(*b*) The diffusion of this knowledge among the members of the Association, with the view of increasing the accommodation of passengers, improving the service, and reducing the cost of operation.

(*c*) The establishment and maintenance of a spirit of fraternity among the members of the Association by social intercourse.

(*d*) The encouragement of cordial and friendly relations between the tramway undertakings and the public."

It was agreed that the next meeting of the Association should be held in Sydney on October 7, 1908. Officers were elected as follow: President, Mr. Kneeshaw; vice-presidents, Mr. Brain and Mr. Badger; committee, Mr. Parker, Mr. Deakin, and Mr. Thompson.

Mr. Thompson called attention to the desirableness of tramway accounts being standardised as had already been done in England and America, and with this end in view he moved that information should be obtained from the officers of the various tramway undertakings in Australasia as to the classification adopted, and upon receipt thereof the committee should consider it and draw up a report to be circulated among the members of the Association, to be dealt with at the next general meeting. This was agreed to.

Mr. Cowdery read a paper on thermit welding on tramway tracks, and spoke of the good results which had been obtained in Sydney since the first trial in April, 1903. It was the practice there to allow 7 in. per mile for expansion. Expansion spaces were left at every stopping place. The variation of temperature in Sydney was 70 deg. F. In thermit welding of tracks, Leeds, the pioneer in England, was only a few weeks ahead of Sydney, while Sydney was a few weeks ahead of any city in the United States to adopt it. Directions had been given that in future all lines in Sydney likely to carry a fair traffic were to be thermit welded. His best advice and last words were, weld, weld, weld.

At the meeting on Saturday, November 9, the following additional members were elected; Mr. George Macoun, accountant in the electrical engineer's department of the Sydney tramways; Mr. E. J. Cochrane, chief assistant to the engineer and general manager of Ballarat and Bendigo tramways; Mr. Ford, resident engineer at Bendigo; and Mr. W. Knox, chief accountant to the Ballarat and Bendigo Company. Mr. Macoun was then elected secretary and treasurer of the Association.

It was decided that the secretary should communicate with the officers of the various tramway systems in Australasia for the purpose of obtaining statistics, in order that returns might be prepared showing the extent of the tramway undertakings and the volume of business transacted.

The question of the eyesight test applied to employees was informally discussed, and the president was requested to collate all the available data, with a view to its distribution among the members of the association.

The members subsequently inspected the Randwick workshops and examined a car fitted with regenerative control.

TRAMCAR BRAKES.

In the afternoon Mr. O. W. Brain read the following interesting paper on brakes:

The subject of brakes has been selected for this short paper as one likely to be of some service to the members visiting Sydney, in view of the fact that this city can claim an experience in the matter that is, in some respects, unique; and also as examples of all the types of brakes which have been adopted here from time to time, as the art progressed, can, with perhaps one exception, still be seen in service in the streets.

Among the tramway systems running into hundreds of cars, it is thought that that of Sydney stands alone in having on the whole of its steam, cable, and electric rolling-stock employed power-brakes on every car, and in having adopted this practice in connection with the electric equipment from its initiation, with the exception of the first one or two experimental cars. These latter were merely examples of the small "bob-tail" or glorified horse-car which prevailed in American practice at that time.

The experience here should also be the more useful for reference, in view of the steepness of the grades and the conditions associated with them, which are certainly exceptionally severe. Among these may be mentioned the 1 in 8·75 grade towards the top of a 30-chain grade largely of 1 in 10 on the King Street line, the 10 chains of 1 in 10 ending abruptly on a wharf at Neutral Bay, the numerous curves of 1 chain radius and thereabouts on grades up to 1 in 12 between rock and precipice on the Spit line, and other lengths of steep and sinuous track at North Sydney, Watson's Bay line, and elsewhere.

Then, again, an unusual feature involving special braking considerations, is the practice of running considerable numbers of coupled motor cars, and not infrequently attaching to them seventy-seating double-bogie trail cars. This practice would appear at first sight to involve a sacrifice of the fundamental advantage of electric tramways—the one feature, in fact, which has enforced their recognition and enabled them to displace all competitors the world over, viz., the ability to economically operate single-car units frequently. It has to be borne in mind, however, that the topographical conditions of Sydney are such that the main arteries leading into the city on the surface of the land are, and always must be, limited to a very small number.

At the present time, although the extent to which the streets are monopolised by the tramways has already occasioned some complaint, there are only four double tracks into the city. It is certain that this number will admit of only very slight increase. Now, the number of units which can be passed along a street in an hour has, under tramway conditions, a certain definite maximum, after which any attempt to further increase the number merely means that the additional units will not get through. If, therefore, the number of cars requisite to carry the passengers is greater than the number of units that can be passed through in the time, it is clear that some of the units must consist of more than one car if the service is to meet with the requirements of the traffic. A very casual inspection of the maximum evening traffic is needed to convince one that the Sydney service must necessarily reach this stage during the heaviest daily loading; and the requisite size of unit has been obtained by coupling motor cars, and also by drawing a trailer behind a single motor car or a pair of coupled motor cars. The latter, representing a three-car unit, requires a brake powerful and prompt in its action on all cars.

As it is understood that utility is to be a primary feature of this Association's work, a history of brake practice in Sydney would be out of place. It will suffice, therefore, to enumerate the types of brake used in the order of adoption.

On the steam trams the Eames' vacuum brake has been used for many years on trains of as many as five trailers and a steam dummy. This brake is still used at Newcastle, Broken Hill, and on the one or two isolated services where steam continues to be used. Each trailer is also equipped with a hand-brake.

The first cable trams were equipped with hand-brakes on the dummy and trailer. There was, in addition, a powerful track-brake on the dummy. Later, the hand-brakes on the dummies were discarded, an air-brake made by the Gennett Company being adopted. The compressor was of the double cylinder axle-driven type, with flat cast-iron rubbing discs on either side of the eccentric sheave on the axle. Still

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later, an improvement was made by the substitution of an eccentric strap and connecting rod, designed in the department. That was the practice at the time when the last of the cable tramways was converted to electric working.

The use of the department's type of compressor was continued on the earlier electric motor cars, with hand brakes only. Later, a few of the Standard Company's motor-driven compressors were used. Then a sample electric disc brake, made by the American General Electric Company, was imported; but the axle-driven compressors retained the field until the Christensen motor-driven compressors were tried, since when this type has been used for all additional air brakes, with the exception of one or two samples of other makes. Meanwhile, on the very heavy grades of King Street, on which a few electric cars had to assist the cable service, and on the Neutral Bay line, the Spencer track brake had been adopted in addition to the air and hand brake.

With the complete conversion of the King Street cable line to electric working, the four-wheel motor cars adopted on that service were furnished with Newell magnetic B type brakes, the old pattern of shoe being used. As this is a track brake, the only additional brake was the hand brake, which operates special wheel shoes, and is, therefore, entirely separate from the magnetic brake gear.

The Newell brake was also applied to a number of eight-wheel cars built shortly afterwards, but Christensen air brakes continue to be installed on cars intended to be operated in pairs.

In addition to the types of braking equipment mentioned in the foregoing, one sample Raworth regenerative car has been in service on the King Street line since April last.

As an additional precaution, drivers are instructed, in cases of emergency, to reverse the motors and apply current, or, as a last resort, to open the main switch and put the reversed motors into parallel, so that they will act as generators on short circuit. The latter requirement is in the double motor equipment effected in the usual manner, by passing the driving controller-handle on to the parallel notches, but with the coupled motor-cars no movement of this handle is necessary, as the equipments of the two cars are permanently in parallel.

It is always difficult to get the staff to appreciate that these electrical reversals are not so reliable as a good brake, the inclination being to regard them as a more powerful means of stopping the car, which should always be available if the equipment is in order. Of course, the power brakes are set to exert the maximum pressure on the shoes which may be incurred under usual conditions without risk of skidding the wheels. Any greater retardation of the wheels will thus probably be attended with skidding, resulting in a greater distance being travelled before the car is brought to rest. The driver should only therefore resort to the electric reversals in case of brake failure, or of his seeing that it is too late for the brake to avert an accident. In the latter case, the only hope is that by good fortune the condition of the rail surface may be exceptionally favourable, resulting in unusually high adhesion, in which case a very quick stop may be effected by an application of the electric reversal, which is powerful in its action under all circumstances. Obviously, however, it must often be the case that the necessary condition of rail is not present, with the result that an inferior stop is made, and the driver confidently reports that the reversal "failed to act."

As the steam service is not of interest to members generally, consideration will be given to the brakes on the electric stock only.

The electric disc brake was, after extended trial, discarded, as being altogether too spasmodic in its action for regular use.

At the present time there are 767 motor cars in service or under construction, with the following equipments:

(1) 352 cars with air brakes with axle-driven compressors.

(2) 223 cars with air-brakes with motor-driven compressors.

(3) 100 cars without compressors, but permanently coupled to motor cars carrying compressors.

(4) 91 cars with Newell magnetic brakes.

(5) 1 car with Raworth regenerative control.

The air-brakes are all of the "straight air" or non-automatic class.

The type of axle-driven compressor, which was ultimately standardised by the department, and of which the majority of that description of equipment consist, has an eccentric sheave chamber mounted on the axle and carrying the two cylinders. The diameter of the latter is 7 in., the stroke of the piston being 2 in. The free air compressed when a car with 33 in. wheels is travelling at a speed of 8 miles per hour is, therefore, 7·25 cubic feet per minute.

The 7 in. brake cylinder was standardised, the correct shoe-pressure corresponding to weight of car being obtained by suitable arrangement of the levers. The shoe-pressure adopted, as a result of experience and careful observation, is 90 per cent. of the tare of car complete with equipment. An interesting feature of this outfit is the automatic regulator, which, by means of a leather diaphragm, lifts the intake valves of the compressor when the working pressure of 34 lb. to 36 lb. is attained. A very considerable experience of both proved the disc type of driver's control valve to be very much superior to the trip valve. Each motor car carries a reservoir of 4 cubic feet capacity.

There is only one set of wheel-brake shoes, to which both the power and hand gears connect. The latter is so arranged that a handle with a 9 in. radius has a leverage on the shoe of 180 to 1 in the case of a 9 ton car, the leverage on cars of other weights being proportionate. The levers are so arranged that in case of the brakes being applied from both ends, the pressure of the shoe will correspond to the more powerful application, and not to the summation of the two.

Trailers are furnished wtth an equipment providing a shoe-pressure proportionate to their weight, the brake cylinder being connected by means of a coupling-hose direct to the train-pipe of the motor car. Trailers are, therefore, not supplied with reservoirs.

Motor cars that are not kept permanently coupled are equipped with a compressor each, the main pipes of the two cars when coupled being connected by coupling-hose, as well as the train-pipes. The output of both compressors is, therefore, available irrespective of which car is leading.

The cost of a complete axle-driven set, with controllers, gauges, compressor, regulator, reservoir, brake cylinder, and piping, duty paid, and mounted complete on the car in Sydney, is £60, and the weight about 609 lb.

These equipments gave very excellent service for many years. Previous to the relief of the George Street traffic by the opening of the Pitt Street and Castlereagh Street lines, however, the density of the traffic had become such that the brake was constantly in use, and it was then found that the axle-driven compressor did not furnish sufficient air, owing to the short distance travelled between applications. It has also to be admitted that the axle is not a suitable place on which to mount an air-compressor, and the cost of mechanical repairs is, therefore, high in a service on which fairly high speeds are maintained. On both these counts the motor-driven compressor has very much the advantage of the older type.

With the exception of three or four experimental sets of other makes, the whole of the motor-driven equipments have been furnished by the Christensen Company.

The output of the compressor is 11 cubic feet of free air per minute. The working pressure is from 65 lb. to 75 lb., the governor automatically switching in the motor when the air pressure falls to the former, and switching out when it has been pumped up to the latter. One such equipment is found ample for two cars, in addition to the motor-car on which it is mounted. The same general practice with regard to pressures, etc., is observed as in the case of the axle-driven compressor, the same size cylinder being used, with the necessary reduction in leverage in view of the higher air-pressure.

Experience has resulted in special provision being made to prevent trouble in the event of the frame of the compressor equipment becoming alive.

A disc valve, of the makers' special design, is used for the driver's control, the direction of movement having to be reversed in order to conform with the practice previously existing on the trams here.

The compressor requires to be housed in a box measuring 28¾ in. by 24¾ in. by 21½ in. Hitherto, this has been carried under the car floor, secured to the underframe. In future designs, however, it is intended to accommodate the compressor on the floor, under one of the seats.

The cost of a Christensen equipment, including compressor, automatic governor, pressure gauges, controllers, brake cylinder, reservoir, piping, and couplings complete, duty and all charges paid, and mounted on the car in Sydney, is £107, the weight of the whole equipment being about 1,129 lb.

The Newell brake was first adopted on the King Street line, in view of the heavy grades to which reference has already been made. The necessity for a track brake on this service, when added to the air and hand brakes, had involved a cramped and inconvenient arrangement of the gear under the platform for the three types of brake. The Newell brake admitted of a less crowded and more satisfactory lay-out, and at the same time offered a more powerful brake. As members are doubtless aware, this equipment requires the use of a controller with braking notches, as commonly used in England, but the energising coils of the track magnets are included in the circuit when the brake notches are in use. The track magnet is mechanically connected so that the resistance it offers to being dragged along the rail imparts pressure to wheel-shoes, which in the case of the four-wheel cars are provided specially, but on the double bogie cars are the ordinary hand brake shoe. In either case the application of the Newell brake results in three retarding forces against the movement of the car—firstly, that exerted against the rotation of the axle owing to its having to drive the motor while the latter acts as a generator; secondly, the drag of the brake magnet on the rail; and thirdly, the consequent pressure on the wheel shoes on the tyres. The circuit is self-contained on the car, and, therefore, the popular fallacy that a dirty rail will interpose a high resistance in the electric circuit, and thus prevent the brake from operating, is not warranted. A greasy condition of rail may, however, reduce the drag of the magnet, as well as the consequent pressure on the wheel shoes *for a given current*. On the other hand, it may fairly be argued that the current may be increased by travelling over the braking notches of the controller more rapidly, and that on such a rail a brake utilising the adhesion of the wheel alone is in a much worse position. Another source of unjustified apprehension with regard to this brake is the fact that motors are occasionally somewhat sluggish in exciting when reversed and paralleled with the trolley current off, which is known as the "third emergency"

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in Sydney. A little consideration will show that the motors under the latter condition oppose one another, assuming that the residual polarity remains the same as that of operation. The available e.m.f. for starting the self-exciting field current will, therefore, be the difference of e.m.f. of the two armatures, the one of which has to overpower the other and reverse its field. As the speeds are practically the same, and the armatures and fields are identical in their construction, it is not surprising that the e.m.f. generated in the two armatures should occasionally approach very near to being equal, in which case self-excitation will be delayed perhaps indefinitely. This condition is, however, overcome in the arrangement of the braking controller, which parallels the armatures and fields, thus making the full e.m.f. of the weaker armature available for excitation, and obviating the reversal of one field. There is sufficient hardness in the cast steel of the magnetic circuit of the field to ensure prompt building up of the field in all cases, provided the speed of the car is anything more than a crawl.

A feature to be borne in mind in connection with this brake is, however, that the initial voltage, *i.e.*, the e.m.f. due to the residual field alone, is never high, and at low speeds is very low. A comparatively small resistance is therefore sufficient at this stage to prevent the machine building up at all. It has been found necessary on this account to bond the shoe to the distance bar between the shoes, as the mechanical joint between these two was originally in the electric circuit, and its resistance was found to be of importance. For the same reason, it is necessary to maintain a particularly efficient system of inspection of the controllers, as a light contact, which would prove no obstacle to the passage of the 600-volt current on the power side, may make itself felt in the brake circuit. Experience has also shown the wisdom of duplicating the earth-wire connecting the distance bar to the motor base, and of substituting bare for the insulated cables, so that any injury will be apparent.

A matter of importance in connection with the use of the car motors as generators for any purpose is the question as to whether the commutation of the motor will be satisfactory. It has been found necessary here on this account to refrain from using the magnetic brake while coasting down the grades—a limitation which is undesirable. There is no doubt, however, that there is a wide difference between the old pattern of brake shoe which has hitherto been in service here and the pattern of later design. This is amply demonstrated by some tests made by Mr. A. L. C. Fell, of the London County Council, in October of last year, in which it was found that the new shoe effected a retardation of nearly 9 feet per second per second ; and with the hand-brake also applied, the wonderful result of 16 feet per second per second was attained. This is unquestionably beyond the safe limit of retardation with the average class of passengers on board. It would probably be less dangerous and certainly fairer to let the other fellow have a little of the bump. The relieving of the motors by the substitution of the new for the old pattern of shoe on the Sydney equipments is now under consideration. The difference between the patterns is that the magnetic circuit is much shorter in the new than in the old pattern, both through the magnet itself and the path of the flux through the rail. The latter in the old pattern was longitudinally down the rail, while in the new pattern it is transversely through the rail, giving a greater cross-section. The relation of the flux to excitation must, therefore, be much higher in the new pattern. A feature that should be kept in view is the fact that if a more powerful brake be put into the hands of the staff it will be used, *not* with a view to attaining the accustomed retardation with less effort on the part of the motor, but for securing greater ease in keeping the schedule by dint of the time saved with more rapid deceleration. This can be confirmed by observation of the operation of the air and magnetic brakes in Sydney. The author does not know whether his colleague, the traffic superintendent, utilises this feature to improve his schedule. Accepting, however, in anticipation, the denial of the soft impeachment, he thinks Mr. Kneeshaw will agree that the cars equipped with the magnetic brake are customarily brought up to the stopping places at a higher speed, and stopped more rapidly, than with the air-brakes, although, so far, the shoe used is, with one exception, of the old pattern. It is also understood that the drivers claim to be able to keep the schedule better with them. While this all goes to show that the adoption of the more effective new pattern of shoe will be advantageous, it also points the moral that with any type of brake with which higher and higher deceleration can be obtained at the cost of increasing duty imposed on the armature, it is necessary to have a wide margin in the performances of the motor as to heating, and particularly sparking. The basic principle which underlies this conclusion is probably the fact that more rapid deceleration, within certain limits, means improved earning power, and is, therefore, apt to be utilised when available.

From some observations made in connection with this brake, it was thought that the tractive effort required to draw the magnetic shoe along the rail was less than that due to the co-efficient of friction if a mechanical pressure were applied equal to the lift necessary to raise the shoe off the rail ; in other words, that the latter was greater than the actual pressure. Careful tests carried out by Mr. Shenstone, an officer of the department, demonstrated, however, that the reverse was the case. The resistance due to friction is greater in the case of the magnetic shoe under conditions of apparently equal pressure. In connection with these tests, Mr. Shenstone observed that powdered metal was left on the surface after each test of the magnetic shoe, but not after the weighted shoe. The explanation of this would appear to be that the up-ending of the atoms of the surfaces of the metal, in accordance with the path of the magnetic flux, causes these projecting atoms of the two opposing faces to mesh or gear together. The consequent dislodging of a number of these atoms would account at once for the presence of the metal-dust, and also for the additional retardation as compared with unmagnetised metal with equal pressure. It may be thought from this that the wear of the magnetic shoe will be greater than that of the mechanically-applied shoe. Practice does not, however, indicate that this is so for *equal retardation* of the car.

The total cost of the Newell equipment, allowing for the additional cost of substituting a "B" controller for one of the "K" type, and including the supply of the track magnets and special wheel-shoes, and all suspending and connecting gear and cables, duty paid, and mounted complete on a four-wheel car, equipped with two 40-H.P. motors, in Sydney, is £96. The additional weight, as compared with a car with "K" controllers and hand-brake only, is 1,232 lb.

The Raworth regenerative control has now been on trial for about six months. In view of the radical change in the method of operation, it had been thought that the drivers here were unlikely to be favourable to this system. The reverse, however, appears to be the case, so far as can be judged by the short period the equipment has been on trial ; some of the drivers, in fact, speaking quite favourably of it from their point of view. The operation of the car fitted with this brake has been satisfactory ; but the cost of wear and tear has not yet been established. The unreliability of the control at speeds of under 6 miles an hour is a feature that might prove of importance from points of view other than engineering, and justifies caution in connection with its adoption. The cost of the equipment was £450, which included fitting the equipment to the car. The labour and supervision of the erection were furnished by the department.

In apologising sincerely for the absence of merit which the author recognises in this paper, he can only ask for leniency on the ground that when he undertook the task it was his intention to follow up one or two special phases of this subject which he had hoped would have imparted some originality and special interest to it. Quite exceptional circumstances have, however, prevented his giving the time he had intended to the work. He hopes, nevertheless, that these hurried notes will prove of some little service to the members of this Association.

The proceedings of the gathering were closed by a visit to the Ultimo power-station.

OPENING FOR CAPITAL IN ASSAM.

The Indian newspapers report a speech made by Sir Lancelot Hare, Lieutenant-Governor of Eastern Bengal and Assam, early in December in reference to the construction of tramways in Assam for connecting various districts with existing railways. He said that much had been talked of and written on the subject, but no terms had yet been agreed to which the public investor was prepared to accept. The local investing public did not seem to be large enough, and the wider public did not know or care enough about the schemes to run any risk without a guarantee of interest. If he could obtain the consent of the Government of India, he would be prepared to devote a fair amount of money towards meeting the claims under a guarantee. Looking to the configuration of the province, a series of short lines linking up the railway and the river with the chief producing and trade centres, and not any one long line only, were clearly indicated. Several such lines should be under a single company, with single management, single stock and a single main workshop. In this way much saving could be effected. It was well understood that, standing alone, a short line could not afford the expenses of efficient management. On the average about 25,000 rupees per mile was required for a fully-equipped tram line. He would like to see 100 miles, more or less, built in the Assam Valley and 100 miles in the Surma Valley, under two companies as a beginning. He had little doubt that if, say, two lakhs of rupees a year could be guaranteed for the possible payment of interest, it would be a very good provincial investment ; and very great and substantial progress would be made.

New York Subway Extension.—The extension of the New York Subway under the East River to Brooklyn was opened for traffic on January 9, and at once resulted in considerable relief to the excessive congestion of traffic on Brooklyn Bridge. The trains on the extension of the Subway were crowded, and there was much local celebration. The work of construction has been in progress since September, 1902.

Tramway Electrification in Russia.—It is announced that the Odessa tramways are to be extended over a distance of 140 kilomètres and converted to electric traction. It is also reported that the contractors for the electrification of Moscow tramways have deposited with the Russian Imperial Bank £10,000 required as a guarantee. The Municipality intend to issue a loan of £1,870,000 for defraying the cost of construction and equipment.

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BIRMINGHAM CORPORATION TRAMWAY ACCIDENT.

REPORT BY LIEUT.-COL. H. A. YORKE.

We give below the full text of the report to the Board of Trade by Lieut.-Col. H. A. Yorke on the accident which occurred in Birmingham on October 1:

I have the honour to report for the information of the Board of Trade, in compliance with your Order of October 4, the result of my inquiry into the accident that occurred on the Birmingham Corporation Tramways at about 6-35 a.m., on the morning of October 1.

In this case, as tramcar No. 22 was descending the incline in Warstone Lane, the motorman (Inspector Hall) lost control of it, with the result that it ran away down the incline, and was overturned at the corner of Warstone Lane and Icknield Street, striking an overhead standard as it fell. Two passengers died from injuries received, and twelve were injured more or less seriously.

The car was a four-wheeled, double-decked car, fitted with the hand brake, electric rheostatic brake, and the magnetic track brake, and also with four sanders, namely two at each end, and a lifeguard of the trigger type. The total length of the car was 27 ft. 6 in., the wheel-base being 6 ft. The gauge of the tramway is 3 ft. 6 in.

At the time of the accident there were about 16 passengers on the car, half of whom were inside and the other half on the top. Most of the inside passengers succeeded in jumping off before the upset, receiving slight injuries in so doing. The passengers who received the fatal or serious injuries were those on top of the car.

Warstone Lane is about a quarter of a mile long, the gradients in it being as follows, commencing from the top of the hill: 1 in 143·8, 1 in 22·7, 1 in 17, 1 in 19·7, and 1 in 36·6. Warstone Lane itself is straight, but there are curves at the top and bottom of it, that at the foot of the hill being the worst. There is a double line of tramway along the Lane, and the curve of the line upon which the car was travelling, between Warstone Lane and Hingeston Street, which is at the foot of the hill, has a radius of 40 feet, the curvature being to the right. The superelevation of the outer rail at the centre of the curve is 1¾ in. In consequence of the gradients in Warstone Lane, the regulations of the Corporation provide that all cars shall stop at both the top and bottom of the hill, and that the speed round the curves shall not exceed four miles an hour.

Car No. 22 left the depôt at 4-59 a.m., in charge of motorman J. E. Mountford. This man says that he made the usual examination of the car before starting and found that everything was right, and that the sand hoppers were full of sand. The car had to proceed from Rosebery Street depôt to the city terminus at Edmund Street before coming into service. On the way to Edmund Street, Mountford says he tested his magnetic brake, and found that it had no effect when the brake handle was on the first and second notches, acted indifferently at the third notch, and did not come into full effect until the handle was on the fourth notch, when it brought the car up with a jerk. Mountford was then using the controller at "No. 2" end of the car, which was at that time the leading end. He left Edmund Street at 5-9 a.m. for the other terminus of the route at Foundry Road, and descended the hill in Warstone Lane with safety by means of the hand brake. On returning from Foundry Road he was driving at "No. 1" end of the car, when he states that he found that the magnetic brake acted satisfactorily on all the notches. On arriving again at Edmund Street he met Inspector Hall, and informed him that there was something wrong with the magnetic brake at "No. 2" end of the car, and arranged that he should meet him on the following journey from Foundry Road and try the brake. Mountford then proceeded to Foundry Road, still being at "No. 1" end of the car. On the return trip from Foundry Road he was driving from "No. 2" end* and on nearing Edmund Street terminus he picked up Inspector Hall. The car left Edmund Street for the third trip to Foundry Road at 6-29 a.m., with Inspector Hall in charge of the car, and motorman Mountford standing alongside of him, but not taking any part in the handling of the car, which was still being driven from "No. 2" end. Inspector Hall seems to have tried the magnetic brake when going down the incline in Summer Row, with the result that on the first, second, and third notches it did not act properly, but brought the car up with a jerk when the handle was moved to the fourth notch. Inspector Hall continued on the journey and stopped, as required by the regulations, at the corner of Frederick Street and Warstone Lane. When he reached the incline in Warstone Lane he again tried the magnetic brake, which on this occasion seems to have completely failed on all notches. He then moved the handle to the "off" position and tried the brake a second time, but still without effect. He then tried to stop the car by reversing the handle from the forward to the back position, and moving the controller handle to the sixth notch of power, but still without effect. By this time he was more than half-way down the hill, and had entirely lost control of the car. He then applied his hand brake for the first time, to the fullest possible extent, but the speed of the car was such that the hand brake had little or no effect in checking it. On reaching the curve at the bottom of Warstone Lane hill the wheels skidded, and almost immediately afterwards the car turned over to the outside of the curve and fell on its side, striking a trolley wire standard in its fall, the passengers on the top being thrown on to the pavement, and one of them crushed between the standard and the car.

The immediate cause of this disaster was the action of Inspector Hall in taking the car down Warstone Lane with a defective magnetic track brake, and experimenting with that brake on the incline. Had he applied the hand brake before starting down the incline, no accident would have occurred, as the gradients are such that the car might well have been controlled by means of the hand brake only, the only precaution necessary being that the hand brake should be applied at the commencement of the hill, so that the speed of the car should be checked from the outset. That this is the case is proved by the fact that motorman Mountford had already taken the car down the hill that morning by means of the hand brake only. Inspector Hall seems, however, to have selected this hill for the purpose of testing the magnetic brake, and did not attempt to apply the hand brake until the speed of the car was far beyond its control.

Rule 28 of the printed rules and regulations issued by the Corporation for the guidance of their motormen is as follows:

> "Any defect in the mechanical or electrical equipment of the car, whether the result of an accident or otherwise, must be reported in the book provided for that purpose in the car shed.
>
> "If a defect is discovered on the road, and cannot be remedied by the motorman, the attention of the nearest inspector should be called to it.
>
> "*Motormen must in no case* take the risk of running a car which is not under absolute control."

In drawing the attention of Inspector Hall to the defect in the magnetic brake, motorman Mountford seems to have complied with this rule, and the responsibility for the accident must rest upon Inspector Hall, whose action was entirely contrary to the spirit of the last sentence in the rule.

The failure of the magnetic track brake to act on this occasion is said to have been due to a broken "grid" in the fourth resistance box on the car. According to a statement made by Mr. C. W. Hill, electrical engineer of the Corporation tramways, the controller at "No. 2" end of the car, and the insulation of the cabling and wiring of the car, were after the accident found to be in good order, and the only defect that could be discovered was the broken grid. The resistance boxes, of which there are five, are in use both for propelling and braking purposes, and it might be thought that such a fracture would be discoverable, not only when the magnetic brake was in use, but also when current was being supplied from the trolley wire for the purpose of starting the car. Mr. Hill's theory is that the electrical pressure of the current for driving purposes would be sufficiently great to bridge the gap formed by the fracture, whereas, in the initial stages of braking, current generated by the motors acting as generators would have a low pressure, and would not be able to overcome the interruption in the circuit. Experiments made in my presence by Mr. Trotter, the electrical adviser to the Board of Trade, at 8, Richmond Terrace, however, hardly support this theory, as it was found that a current of 10 amperes, which is probably less than the usual current passing when cars are starting from rest, is sufficient to cause fusing to take place between the two opposing ends of the fracture, and between the sides of the broken and adjacent members of the grid. No such signs of fusing were, however, discernible in this case. It is therefore impossible for me to say whether the above explanation of the failure of the magnetic track brake is the correct one or not.

* The reason why the motorman has to change ends at the terminus at Foundry Road is because at that terminus there is only a cross-over road between the two tracks; whereas, at the terminus at Edmund Street, no change of end is needed owing to the fact that there is a loop round which the cars run.

The Projected Lucknow Tramways.—It is reported from Lucknow, India, that the Municipality have agreed to recommend the Government to extend by nine months the time allowed to the British Eastern Electric Company for the construction of the proposed electric tramways in Lucknow. The Municipality, however, resolved that this should be the last extension of time to be granted.

Improved Time Recorder.—In these days of keen competition the manufacturer cannot afford to brush aside any means whereby greater efficiency and better discipline can be effected in the factory. To enable employers to obtain absolutely accurate printed evidence of time worked by their employees, automatic time recorders were introduced into this country ten years ago by the International Time Recording Company of London. To perfect their systems and machines, improvements have been designed from year to year. Their latest, and we consider, most important forward move has been made in their "Rochester card recorder." This machine now automatically prints in blue the time of "regular arrivals" and in red the "late comers" and "overtime." This improved "Rochester" should prove a great boon to employers and to their time and cost clerks.

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SERIOUS ACCIDENT IN GLASGOW.

On Friday evening, January 3, a serious accident occurred in Glasgow, when a car descending High Street, one of the steepest tramway gradients in the city, got out of control. The weather was frosty and foggy, and the street was thronged with lorries and vans. The car had over 30 passengers. Soon after the car began to gather speed, it collided with an aerated water lorry. The lorry was smashed, the horse was killed, and a man and a boy in charge were thrown on the street. The boy, Robert Heggie, died in the infirmary a few hours later. A little further on a collision occurred with a railway lorry, and James Dolan, the driver of the car, was thrown out, and died from his injuries soon afterwards. The lorry was wrecked, but the driver and horse escaped. The windows of the car were shattered, and the passengers thrown into a state of great alarm. The wild rush of the car was not checked, and a little further on it struck an empty lorry, capsizing and smashing it, injuring the horse and throwing the driver to the ground. The chances of collision were the greater, as there was now no car driver to ring the warning bell. Fortunately when the car crossed Duke Street, there were no cars on the cross route in the way, and this dangerous spot was passed without further disaster. A similar escape took place at Glasgow Cross, where several tramway routes converge. The policemen on point duty, seeing the car coming down at terrifying speed, cleared pedestrians out of the way. The car had now got to the level, and began to slow down, but before it finally stopped it collided with a fourth lorry, to which it did some damage, but the driver and horse escaped. Besides the two cases of fatal injury, some eight or nine people were more or less hurt. The safety of the passengers in the car was secured by the exertions of the conductor, Walter Child, who stood in the doorway and prevented the people from jumping off, as many of them wanted to do. Several of them suffered from shock. Dolan, the motorman, had been in the service of the tramway department since 1894. Since the beginning of electric traction on the system in 1901, he had acted as a motorman, passing all the periodical examinations and gaining the usual certificates. Dolan regularly earned the bonus for freedom from accidents, his record being clear.

On Jan. 14 Colonel Yorke, on behalf of the Board of Trade, held an inquiry in Glasgow with regard to the accident. The proceedings were public.

The evidence was opened by several witnesses, who spoke to having thoroughly examined the car at the Langside depôt on January 1 and 2, and also on the morning of the day of the accident. It was examined along with others in the ordinary course. A new brake-shoe was fitted, and the brake gear was adjusted generally. The car was in thorough order.

Walter Child, the conductor of the car, said that he and James Dolan, the motorman, joined it at 2.58 in the afternoon. Their first journey on it was from Mount Florida to Springburn, and everything was then all right. After returning, they did a second journey from Mount Florida to Springburn, arriving at Springburn at 4.47. When at the Springburn terminus, it was found that the reversing handle would not come off the controller. Dolan made no objection—at least in witness' hearing—to proceeding. The reversing handle was left on what was now the rear controller. A start was made back from Springburn about 4.52. He stopped at the compulsory stopping-places on the journey. It was somewhat foggy. It was when they were passing the lane near the prison wall that he first thought the motorman was in difficulties. Witness was on the platform at the time. He could not see the driver, as the passengers were standing up terrified. The speed was at its highest at College goods station. Witness described the collisions, and said he did not notice where the driver fell off. Their greatest speed was at least 25 or 30 miles an hour, the maximum being reached just before they struck the first vehicle. At Glasgow Cross the speed would be 10 or 14 miles an hour. He applied his brake then, because by that time he felt there was something far wrong when the car did not stop.

In cross-examination the witness said that as the reversing lever was out of action, the braking was confined to two methods, the hand brake and the magnetic brake. If he had been signalled to put the brakes on at the back, he would have tried to do so. He believed that Dolan did everything possible to keep the car under control. At the end Dolan had been using the electric brake with all his force.

Colonel Yorke pointed out that if the conductor had applied his hand brake at the wrong time, at a time when it was not required, it might have had the effect of interfering with the working of the magnetic brake, and therefore the conductors were warned not to apply their brakes unless they got a distinct signal to do so from the motormen in front.

William Falconer, timekeeper, said he had tried to get the reversing lever off the controller before the car left Springburn, but had failed.

Colonel Yorke said that he had had the inspection of these electric tramways, and stated that the Board of Trade did not call upon the Corporation to adopt the magnetic brake. It was a voluntary action on the part of the Corporation to adopt it in addition to the hand brake and the other brakes. They adopted it in order to facilitate their service and the working of the cars with greater certainty in traffic. The Board of Trade welcomed the decision of the Corporation in adopting the magnetic brake on their cars. They were one of the first bodies to do so. He only said that in fairness to the Corporation, because it showed that the Board of Trade did not consider it necessary for safety to have four brakes on the cars. The Board of Trade distinctly stipulated the hand brake, the rheostatic brake, and the power to reverse the motors of the car, and so bring it to rest. This final operation was only to be done in the greatest of emergencies.

John Muirhead, motor inspector, also spoke as to the reversing lever, and said he knew that this trouble did not affect the operation of the hand or the electric brake. He instructed the motorman to proceed towards Mount Florida, and asked the timekeeper to ring up Langside for a fitter to meet the car on its arrival there, and, if necessary, exchange it. Dolan left without a murmur; he had no hesitation in leaving, and witness had no hesitation in allowing him to go. He could not exactly say that the motorman was under his orders. Witness simply reported a man for abusing his equipment. Dolan would have been within his rights if he had objected to take the car downhill. If witness had had any doubt as to the safety of the car, it would not have left Springburn. Dolan was a very capable driver. A car had often been taken down the incline with the hand brake in safety. The route was opened before mechanical brakes were fitted. The witness declined to answer a question put by Mr. T. Scanlan, for the relatives of Dolan, as to whether it was a breach of the rules to ask Dolan to proceed with the car when it was defective.

John Ferguson, engineer, Corporation Tramways, who examined the car at the Langside depôt after the accident, detailed the extent of the damage. There was no indication that the hand brake was in use. The brakes were due to be adjusted that night, but they were in quite good condition. The sand-holders were practically full, and the gear was in working order. The wheels had run less than 8,000 miles since they were put in. So far as he could see, the magnetic brake was in good order, but he did not test it. He would not have anticipated any danger from the car being allowed to proceed with the reversing gear out of order.

Alexander Gerrard, who said he had charge of the car building and repair shops at Coplawhill, stated that he examined the car after the accident. Witness found controller No. 1 (that was the undamaged one) with the reversing handle stuck in the forward position. That was owing to a pawl dropping, due to a pivot having become unscrewed. No. 2, the damaged one, had the main handle on the full braking point and the reversing spindle in the forward position minus the handle. The entire cabling of the car was in perfect order. Witness tested the electric brake with a new controller, and found that the connections outside the controller and the brake shoes were in perfect order. He also drove the car from the other end, and found it in the same condition. The hand-brakes on both ends were also tested by him and found in good working order.

Police evidence was given to show that before Dolan was thrown off the car he appeared to be working the brakes.

Professor A. Jamieson was called by Mr. Scanlan, and gave the opinion that none of the four methods for controlling the car could be dispensed with consistently with the safety of the public.

The inquiry was closed, Colonel Yorke intimating that he would report to the Board of Trade in due course.

An inquiry under the Fatal Accidents Inquiry (Scotland) Acts was held in Glasgow on January 23 before a Sheriff and jury, regarding the deaths of James Dolan, tramway motorman, and Robert Heggie, van boy. The evidence was similar to that given at the Board of Trade inquiry on January 14. The jury returned a formal verdict. They added that there was not sufficient evidence to show how the car got beyond the driver's control, but the jury were of opinion that the reversing handle not being in its proper place at the time of starting, the car should not have been sent on its journey.

Cowan's Limited, have secured contracts for switchboards for H.M. battleships "Minotaur" and "Shannon," also for Gibraltar Dockyard; seven switchboards for the lighting of the Franco-British Exhibition (including Andrew's patent discriminating devices); and a repeat order for sub-station switchgear for Hammersmith Council (including Andrew's reverse-current relays).

Bruce Peebles and Company, Limited, have secured, through Messrs. Willans and Robinson, a Stepney Borough Council order for a 2,000 kw., 6,000 volts, 50 cycle, 3-phase alternator, to be driven at 1,500 r.p.m. by Messrs. Willans and Robinson's steam turbine. They have also an order from Cardiff Corporation for a 250 kw Peebles-La Cour motor converter, this being a duplicate of a unit previously ordered.

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TRAMWAY AND ELECTRIC RAILWAY LEGISLATION.

SESSION OF 1908.

In our issue of December 5 last appeared a list of tramway and electric railway bills to be promoted in the session of Parliament just opened, together with a statement of the main objects of the measures. We now present our usual tables, giving lengths of lines proposed, estimated cost and capital powers, these being now obtainable since the bills and relative documents have been deposited at the Parliamentary offices.

The number of bills is not appreciably greater than the small total of last year, being 32, as against 30. The number of which notice was given in November was 33, but one, the Rhondda Urban District Council Bill, as to the reconstruction of two bridges to carry tramways over the Taff Vale Railway, was not deposited. The number of bills promoted by companies is 14, against 18 last year. Of these, 8 propose new works and capital, against 13 last year. The total length of lines, reckoned as single track, is over 80 miles, compared with 124 miles last year. The estimated cost (which excludes equipment) is £2,357,988, against £6,549,219, and the new capital is £3,007,333, against £10,199,000. The money figures were largely increased last year by the Channel Tunnel and the London and North Western Railway electric railway schemes. One marked peculiarity shown by Table 1 is that the whole of the proposed new lines are in London and its vicinity. The discouragements to private enterprise have at length succeeded in reducing tramway proposals by companies throughout the country except in the Metropolitan district to zero. This undesirable state of things can hardly continue. It may also be noted that the bulk of the proposed capital is in connection with two competitive motor road schemes, one of which has tramways associated with it.

Local authorities are promoting 18 bills, of which all but two propose new lines or fresh borrowing powers, or both, as against 12, including nine proposing new works last year. The schemes, however, are small, being confined to short extensions of tramway systems and to powers to run motor omnibuses. The length of lines, measured as single track, is 38 miles, compared with 71 miles a year ago, and the estimated cost (which in the case of local authorities includes equipment) is £938,349, against £2,114,133. The fresh borrowing powers amount to £998,387, against £2,114,557. The municipalities appear in the meantime to desire no further extensions of great importance, while they have helped to prevent the natural expansion which would have been carried on by companies.

The total figures for both companies and local authorities are thus 118¾ miles of single track, against 195½ miles last year; estimated cost, £3,296,337, against £8,663,332; and new capital and borrowing powers, £4,005,720, against £12,313,557.

Since the bills were lodged the possibility has arisen that the following bills promoted by local authorities will not be proceeded with: Belfast Corporation, Bolton Corporation, Erith Tramways, Kingston-upon-Hull Corporation, and Morecambe Corporation Tramways. These bills have been rejected by towns' meetings, but polls of the ratepayers are in some cases being taken, upon the results of which the decisions to proceed with or to abandon the measures depend. In the cases of Bolton and Erith the promoters have decide to abandon the bills.

NOTES.

COMPANIES' BILLS (TABLE I.)

CROYDON AND DISTRICT TRAMWAYS.—This bill incorporates a company, and the promoters named are J. B. Braithwaite, F. W. Reynolds, A. H. Sanderson, F. E. Savory, R. P. Sellon, and Joseph Shaw.

LONDON MOTOR ROADWAYS APPROACH.—The promoters are the Roads Construction Company, Limited, a company registered under the Companies' Acts. Thus, no statement of capital of the company is required in the bill. The motor roads proposed are to run from Hammersmith to the Bath Road, near Eton, but the exact length is not stated.

LONDON AND WINDSOR MOTOR ROADS, TRAMROADS, AND TRAMWAYS.—A company is to be incorporated by the bill, and the promoters named are F. L. Davies, W. N. Lewis, H. W. W. Davey, and H. F. Ensor. The scheme is the largest, from the capital point of view, of all the land transport proposals of the session. The motor roads, apart from the tramroads and tramways, are estimated to cost £1,132,977, out of which £626,233 is for works and the rest for land. The tramroads are to be deemed to be a railway.

WEST LONDON, BARNES, AND RICHMOND TRAMWAYS.—The bill incorporates a company, and the promoters named are F. W. Reynolds, A. H. Sanderson, F. E. Savory, R. P. Sellon, and H. B. Renwick. The long period of 60 years is asked before the local authorities can purchase the undertaking. An enormous amount of road widening for the tramways is proposed, the land for which and the work of widening are estimated to cost no less than £105,244 out of the total estimate quoted in the table.

The following additional bills promoted by companies do not propose any new lines or additional capital: Bristol Tramways, Great Northern, Piccadilly, and Brompton Railway, Highgate Hill Tramways, Macclesfield and District Tramways (Abandonment), North East London Railway, Nottinghamshire and Derbyshire Tramways.

LOCAL AUTHORITIES' BILLS (TABLE II.)

AYR CORPORATION TRAMWAYS.—£2,430 out of the total estimate is for purchase of land and street improvements necessitated by the tramways.

BOLTON CORPORATION.—Out of the total estimate, £17,457 is for street widenings for the tramways.

BURNLEY CORPORATION.—The estimate includes money for obtaining motor omnibuses and £54,000 for street improvements associated with the tramways.

DONCASTER CORPORATION.—A new road and road widenings for tramway purposes are included in the scheme, the cost of which is put at £150,000, leaving only £9,000 for tramways proper.

KEIGHLEY CORPORATION.—The estimate is for motor omnibuses.

KINGSTON-UPON-HULL CORPORATION.—Street improvements are to cost £31,500 out of the total, and the remaining figure includes £40,500 for cars and additions to the power plant.

LEEDS CORPORATION.—£15,000 of the estimate is for cost of tramways authorised by the Pudsey Tramways Order, 1905, which are being taken over.

LONDON COUNTY COUNCIL (TRAMWAYS AND IMPROVEMENTS).—£84,900 of the estimate is for street improvements.

MERTHYR TYDFIL CORPORATION.—The estimate is for motor omnibuses.

MORECAMBE CORPORATION TRAMWAYS.—Part of the lines will be reconstruction of existing tramways.

ROCHDALE CORPORATION.—Out of the total cost, £19,000 is for a new street required for the tramways.

WIDNES CORPORATION.—The estimate is for motor omnibuses.

The following additional bills promoted by local authorities do not propose any new lines or fresh borrowing powers: Erith Tramways, Wolverhampton Corporation.

TABLE I. COMPANIES' BILLS.	Length in Miles & Chains. Double Track	Single Track.	Total reck'n'd as single track.	Estimated Cost.	Capital.
	M. Ch.	M. Ch.	M. Ch.	£	£
Croydon and District Tramways...	4 16	—	8 32	59,489	113,333
Lanarkshire Tramways	—	—	—	—	204,000
London Motor Roadways Approach	—	—	—	626,578	—
London United Tramways ...	0 29	0 2	0 60	7,399	—
London and Windsor Motor Roads, Tramroads, and Tramways ...	29 7	0 17	58 31	1,449,444	1,620,000
Metropolitan District Railway ...	—	—	—	—	750,000
Metropolitan Electric Tramways...	1 14	—	2 28	50,738	—
West London, Barnes, and Richmond Tramways	2 61	5 1	10 43	164,340	320,000
Totals	37 47	5 20	80 34	£2,357,988	£3,007,333

TABLE II. LOCAL AUTHORITIES' BILL.	Length in Miles & Chains. Double Track.	Single Track.	Total reck'n'd as single track.	Estimated Cost.	Borrowing Powers.
	M. Ch.	M. Ch.	M. Ch.	£	£
Ayr Corporation Tramways ...	0 69	0 3	1 61	18,250	25,000
Belfast Corporation	—	—	—	—	60,000
Blackburn Corporation	0 21	0 35	0 77	9,200	9,200
Bolton Corporation	—	0 59	0 59	23,550	23,560
Burnley Corporation	0 55	1 4	2 34	124,000	124,000
Doncaster Corporation	0 48	0 12	1 28	159,000	159,000
Keighley Corporation	—	—	—	6,000	6,000
Kingston-on-Hull Corporation ...	1 13	0 21	2 47	105,500	105,500
Leeds Corporation	5 19	0 2	10 40	105,000	105,000
Leith Burgh	1 79	2 17	6 15	56,722	50,000
Liverpool Corporation (General Powers)	0 11	0 10	0 32	2,900	2,900
London County Council (Tramways and Improvements) ...	2 10	2 15	6 35	240,400	240,400
Merthyr Tydfil Corporation ...	—	—	—	5,000	5,000
Morecambe Corporation Tramw'ys	2 32	—	4 64	54,327	54,327
Rochdale Corporation	0 6	0 6	0 18	21,500	21,500
Widnes Corporation	—	—	—	7,000	7,000
Totals	15 43	7 24	38 30	£938,349	£998,387

TABLE III. TOTALS.	Length in Miles & Chains. Double Track.	Single Track.	Total reck'n'd as single track.	Estimated Cost.	Capital or Borrowing Powers.
	M. Ch.	M. Ch.	M. Ch.	£	£
Companies' Bills	37 47	5 20	80 34	2,357,988	3,007,333
Local Authorities' Bills	15 43	7 24	38 30	938,349	998,387
Totals	53 10	12 44	118 64	£3,296,337	£4,005,720

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FINANCIAL COMMENT.

The bank rate has now been reduced to 4 per cent., and unless something entirely unforeseen occurs it will very soon be lower. Experience shows that high rates for money are usually succeeded by very low rates, and there are good reasons for thinking that the present instance will conform to precedent. At the same time it is well to bear in mind that there are reasons which tend to make the rates for money higher than the average for the past two or three decades.

The spending capacity of governments and municipalities throughout the world tends to augment, and the old praises for thrift and the saving of money are little heard of and less regarded. When no one is saving money the cost of borrowing naturally comes heavy to those who need it, and those companies and corporations who live in the hope of replacing old loans at the old rates are inviting disappointment to themselves. The anticipated rise in gilt-edged—or as our friends the socialists would no doubt prefer guilt-edged—stocks, is likely to be a mild and transitory phenomenon. But there is no reason why tramway companies who have borrowed money at cheap rates in the past with no early fixed date for repayment, should not succeed in earning good profits.

DEPRECIATION AND RENEWALS AT DUNDEE.

The report of Mr. Peter Fisher, general manager of the Dundee Corporation tramways, to the Town Council, referred to in our issue of January 18, calls to mind the fact that under Parliamentary powers the amount to be set aside to provide for depreciation and renewals is fixed annually by the assessor of railways. It is of some interest to see what the amounts have been Electrification was completed in July, 1900, and time enough has since elapsed to gauge the trend of depreciation allowances.

The following table is therefore introduced, showing the amounts set aside under this head during the last five years, together with the quantities which are usually invoked for comparison: that is to say, the capital expenditure, the car miles, the passengers carried, and Board of Trade units consumed.

	Capital Expended in thousands.	Car Miles in thousands.	Passengers in thousands.	B.T.U. in thousands.	Depreciation, £.	Maintenance £.	Total Main. and Dep.
May 15, 1903 ..	256,6	908	10,640	1,605	1,340	3,399	4,739
„ 1904 ..	263,	943	11,421	1,661	2,943	3,782	67,26
„ 1905 ..	266,8	933	11,641	1,586	4,371	4,682	90,53
„ 1906 ..	297,	1,006	13,086	1,818	6,401	5,336	11,739
„ 1907 ..	312,8	1,162	15,554	2,207	8,316	6,138	14,454

Also, since the question of depreciation cannot be duly weighed without taking into consideration the scale of expenditure upon maintenance, the amounts charged against revenue under this head are above set out. It will be noticed that since 1903 the allowance for depreciation has been sextupled and more. Meanwhile, the expansion of the undertaking as indicated by the capital expenditure is but a little more than a sixth, the car mileage has increased about a fifth, and the passengers carried by half as much again. It is naturally unwelcome to the council to find depreciation allowances mounting up in this way when the public are looking for reduction of fares. It will be more satisfactory when rate of tramway depreciation is sufficiently understood to enable a fixed sum or a fixed proportion of the capital expenditure to be set aside annually from the commencement, and thus avoid the raising of hopes which have subsequently to be damped by the inexorable necessities of providing for physical decay.

KALGOORLIE ELECTRIC TRAMWAYS, LIMITED.

The traffic receipts of this company are decreasing, and the shares are very near rubbish prices, as may be seen by our list. The 6 per cent. B Debentures are to be bought at three-fourths of their par value which involves a yield of 8 per cent., in spite of the operation of a sinking fund calculated to redeem the A Debentures in seventeen years from June 30th, 1906. Debentures not previously redeemed are to be paid off on Jan. 1st, 1937, at 102½, when the concessions of the company will be falling in. That the securities of the company are now so low is to be ascribed to the poor outlook which faces the town of Kalgoorlie and the surrounding district. The inhabitants depend for their livelihood almost entirely upon the great mines in the neighbourhood, and these are suspected of being almost within sight of exhaustion. No new mines are being opened up, and the prospect of the mining industry is exceedingly gloomy. Should it be extinguished the whole country would probably revert to its original state.

The chairman, addressing the A Debenture holders in September, 1905, congratulated them on holding such a good solid dividend-earning investment as that stock, and spoke of a future for the district in grazing and agriculture. Probably the best hope for the company lies in the possible construction of the trans-continental railway, which is expected to make Kalgoorlie a distributing centre for the country between that town and counties to the south and east. The railway is supposed to be necessary for the defence of Australia; a belief in its early construction was certainly one of the reasons put forward to induce Western Australia to join the Commonwealth.

THE SUNDERLAND DISTRICT ELECTRIC TRAMWAYS.

This company, having got into difficulties chiefly through the adoption of unsuitable plant, was obliged to convene a meeting of its debenture holders on December 30th, 1907, for the purpose of authorising the issue of prior lien debentures to the amount of £20,000. The company is now showing commendable energy in difficult circumstances. Situated in a mining country its receipts have been nearly all on week-end days, running from £40 in the middle of the week, to £140 on Saturdays. The plant has, therefore, been very partially occupied, and it hoped by carrying goods on working days, to somewhat amend these very unsatisfactory conditions.

Further income is expected from the local authorities for road lighting, which is to be effected by the inexpensive device of fixing lamps to the existing standards. The difficult task of raising fares already fixed too low has already been accomplished with the welcome assistance of the labour leaders of the miners, who were brought to see that a private undertaking could not be expected to carry passengers at less than cost; and it is satisfactory to learn that simultaneously with an increase in passengers, the number of car-miles is being reduced.

With these examples of energy and enterprise it is quite possible that, in spite of the debenture charges, second debenture charges, and interest on prior lien bonds, which have been piled on to the undertaking, the unfortunate shareholders may yet see something by way of return upon their investment.

AUCKLAND ELECTRIC TRAMWAYS DEBENTURES.

These debentures, being unaccompanied by junior stocks, occupy an inconspicuous space in the list of prices quoted on the London Stock Exchange, and are apt to escape attention. They, nevertheless, afford sound security for the interest they yield and for their capital value. The tramways are situated in the city and suburbs of Auckland, New Zealand. Those within the city may be purchased by the corporation of that town on June 1st, 1932, or any time after that date, on giving one year's notice, The purchase price will, however, be arrived at by valuing the tramways as a going concern, and though it is stipulated that no account is to be taken of good-will, that cannot greatly affect the issue. The receipts of a tramway does not depend upon the good-will of its customers as to those of a publican or a physician. The tramways without the city, may likewise be purchased by the several district authorities, but the earliest date is two years later, and should any part of the tramway be thus purchased, the company, nevertheless, will retain the right to run cars upon the lines so purchased, as much as may be necessary and expedient to provide an efficient service. In the latter case the local authority is to be paid for the use of its lines upon a scale to be determined by arbitration. This is a fair and reasonable arrangement, a great deal better adapted to encourage the investment of capital than that provided in our Act of 1870.

The authorised amount of the debentures is £300,000, or half the total capital of the company. This would be too high a proportion if the debenture interest were to be a perpetual charge on the undertaking. But the company is under covenant to provide in this month, and hereafter annually, a 1 per cent. sinking fund to be invested in these debentures, by purchase under 105, or by drawings at that price. At this rate the whole issue would be cancelled in about 36 years, so by the time there comes any question of purchase by the city corporation or local authorities the amount of the debentures outstanding will have sunk to within very safe limits. Meantime, the net earnings of the tramways suffice to cover the debenture interest more than three times over, and the provision for maintenance and depreciation seems not only adequate, but even liberal. In any event, apparently, save that of compulsory liquidation of the company, the debentures are redeemable only at 105, and the effect of the sinking fund must be to keep them pretty close up to this figure. They are, therefore, well worth attention by steady-going investors who are not too greedy, but willing to accept a shade under 5 per cent. The price quoted is now a few points above par.

THE BRISTOL TRAMWAYS AND CARRIAGE COMPANY, LIMITED.

This company has such an excellent financial record that in the recent offer of £250,000 4½ per cent. mortgage debenture stock, it was not necessary to enter very fully into the present position or future prospects of the company. A critical date in the company's career is likely to occur in seven years' time, when the Corporation of Bristol will be entitled to exercise its powers under Section 43 of the Tramways Act, 1870, to purchase part of the system within the city. By that time, however, the company no doubt will have so strengthened its position in the surrounding districts that the Corporation will be unlikely to take any steps which would have the effect of disorganising a system of traffic which has already proved of great value to the inhabitants. In any case the debentures issued are sufficiently well-secured to be beyond the reach of any perturbations which may arise. The reserves accumulated are a great credit to the direction of the company, and there are many undertakings in all parts of the country which might imitate, with advantage, its practice in maintenances and renewals, and its method of dealing with depreciation generally.

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TRAMWAY AND OMNIBUS SHARES.

Amount Ranking for Dividend.	Shares.	Name.	Divd. Prev. Half-year.	Divid'd Last Half-year.	Quotations, Jan. 30.	Latest Business Done. Price.	Latest Business Done. Date.	Yield on Buying Price. £ s. d.	Dividend Due.*	Quotations, 1907. Highest	Quotations, 1907. Lowest.
260,007	5	Anglo-Argentine Tramways 6% Cum. 1st Pref.	10%	8%	5⅞—6⅛	6 1/16	Jan. 30	4 19 0	*Apr.*, Oct.	6½	5 21/32
320,000	5	Do. do. 10% Non-Cum. 2nd Pref.	5½%	5½%	7⅞—8⅜	8 3/16	Jan. 30	5 19 6	June, *Dec.*	8	7½
135,000	1	Associated Omnibus Ord.	...	7½d.	1/16—3/16	...	...	...	...	...	...
75,606	1	Bath Electric Tramways Pref. Ord.	5%	for '06	11/16—13/16	...	...	6 3 3	*Apr.*, Oct.	1	3/4
75,000	1	Do. do. 5% Cum. Pref.	5%	5%	13/16—15/16	17/6	Jan. 14	5 6 9	*Jan* & July	1	13/16
15,000	10	Blackpool and Fleetwood Tramways	9/-	4/-	12¾ 12⅞	...	...	5 3 0	22 Aug.	...	...
100,000	16/-	Blackpool, St. Anne's, and Lytham Ord.	..	...	—⅛	...	...	...	...	...	...
50,000	18/-	Do. do. do. 5% Cum. Pref.	...	...	¼—¼	...	...	...	...		...
60,000	10	Bombay Electric Supply and Tramways Co. 6% Cum. Pref.	6%	4/8·377	9¾—9⅞	9 11/16	Jan. 21	6 1 6	Feb., Aug.	8¾	7¾
75,000	5	Brisbane Electric Tramways Investment Co. Ord. ...	...	2/-	3¼—3½	67/6	Jan. 4	2 17 3	*May.*	3 7/16	1 11/16
75,000	5	Do. do. do. do. 5% Cum. Pref.	5%	2/6	4⅝—4⅞	93/9	Jan. 21	5 2 9	*May*, Nov.	5 1/16	4 9/16
50,000	10	Bristol Tramways and Carriage Co....	9½	8½	12½—13	13	Jan. 30	6 18 6	*Feb.*, Aug.	15¼	14
50,000	10	Do. do. do. 4% Cum. Pref.	4*	4	9—9½	9½	Jan. 23	4 4 3	...	...	...
400,000£	Stk.	British Columbia Electric Railway Def. Ord.	7½%	for '06	126—129	127¾	Jan. 30	5 17 3	May, Nov.	135	122½
300,000£	Stk	Do. do. do. Pref. Ord.	6%	for '06	105—109	106¼	Jan. 30	5 1 6	May, Nov.	116½	105
300,000£	Stk.	Do. do. do. 5% Cum. Perp. Pref. ...	5%	for '06	101—104	103½	Jan. 30	4 16 3	May, Nov.	110¾	101
131,301	10	British Electric Traction Ord.	3	3	1—1½	31/3	Jan. 18	...	Apr., *Oct.*	4 17/32	1¼
161,437	10	Do. do. 6% Cum. Pref.	3	3	4—4½	85/-	Jan. 30	...	Feb., *Aug.*	8½	4¼
100,000	5	Buenos Ayres and Belgrano Electric Tramways Ord.	3%	for '06	4⅝—4⅞	...	...	3 1 6	*Apr.*, Oct.	4 9/16	2 31/32
40,000	5	Do. do. do. "A" 6% Cum. Pref.	6%	for '06	4¾—5¼	5	Jan. 22	5 14 3	*Apr.*, Oct.	5½	4¾
27,500	5	Do do. do. "B" do.	6%	for '06	4¾—5¼	...	...	5 14 3	*Apr.*, Oct.	5¾	4¾
113,436	5	Buenos Ayres Grand National Tramways Ord.	...	...	2½—3	53/1½	Jan. 3	...	*Jan.*	3¾	2
90,000	5	Do. do. do. 5% Cum. Pref. ...	6	3/-	3⅞—4⅜	80/-	Jan. 29	5 14 3	...	4¼	3¾
137,610	5	Calcutta Tramways Ord.	9%	7%	6½—7	6¾	Jan. 21	5 14 6	*Apr.*, Oct.	8 15/32	6¾
30,000	5	Do. 5% Cum. Pref.	5%	5%	4⅞—5⅜	5 1/16	Jan. 22	4 13 0	Jan., July	5⅜	5 1/16
491,222	1	Cape Electric Tramways	...	6d.	3/16—7/16	...	...	...	Feb., *Nov.*	9/16	⅝
15,000	10	Carthagena and Herrerias Steam Tramways	7	6%	6—7	6 1/16	Jan. 17	10 8 9	*June*	11¼	6 31/32
40,000	5	City of Birmingham Tramways 5% Cum. Pref.	10%	...	4¼—4¾	85/-	Jan. 10	5 5 3	*Apr.*, Oct.	5½	4 7/16
248,000	5	City of Buenos Ayres Tramways (1904)	5%	1/3	5 3/16—5 7/16	5 11/32	Jan. 30	4 12 0	*Apr.*, Oct.	5½	4 29/32
60,000	1	City of Carlisle Electric Tramways	1¼%	for '06	2/—2/6	...	...	...	...	...	...
5,000	10	Clontarf and Hill of Howth Tramways	...	...	5¾—6	5⅞	Jan. 30	...	...	...	...
11,500	10	Cork Electric Tramways and Lighting Co.	10/-	ann.	9¼—9¾	...	...	5 2 9	*Mar.*	9¾	8¾
12,327	10	Do. do. do. 5% Cum Pref. ...	5/-	5/-	9½—9¾	...	...	5 2 9	Jan. 1, Dec. 30	...	...
3,000	10	Dublin and Lucan Electric Railway 5% Cum. Pref.	5/-	5/-	3½	...	...	...	Sep. 15, Aug. 29	...	...
1,900	10	Do. do. do. Ord.	...	...	...	...	...	...	...	...	...
60,000	10	Dublin United Tramways Co. (1896), Ltd., Ord.	6/-	6/-	13—14	13⅛	Jan. 29	4 5 9	Feb, Aug.	15	12⅞
59,987	10	Do. do. do. 6% Cum. Pref. ...	6/-	6/-	12¾—13¼	13½	Jan. 15	4 7 3	*Feb.*, July	14 13/16	12⅞
40,000	5	Hastings and District Electric Tramways 6% Cum. Pref. ...	...	...	4¼—4½	87/6	Jan. 24	...	...	102	97
20,000	10	Imperial Tramways Ord.	10	8	11—12	11½	Jan. 30	...	...	...	...
20,000	10	Do. 6% Cum. Pref.	6	6	10¼—10¾	10⅝	Jan. 30	...	...	...	...
30,000	5	Isle of Thanet Electric Trys. and Lighting Co. 5% Cum. Pref.	...	1/3	⅞—1⅛	...	...	...	*Mar.*, Sept.	...	...
250,000	1	Kalgoorlie Electric Tramways	...	...	1/16—⅛	...	...	...	*May*	2½	1
28,723	10	Lanarkshire Tramways	...	5/6	10—10½	10⅛	Jan. 30	5 7 6	Feb, Aug.	5/32	1/16
594,188	1	Lisbon Electric Tramways Ord.	5	1/-	15/16—1 1/16	20/-	Jan. 16	4 14 3	*July.*	10½	9¾
425,553	1	Do. do. 6% Cum. Pref...	6	7½d.	⅞—1	...	...	6 0 0	*July.*	1 1/32	29/32
773,592£	Stk.	London General Omnibus Ord.	...	5%	42—47	45	Jan. 28	...	Mar., Sept.	1 5/16	⅞
25,000	10	Do. do. 5% Cum. Pref	5%	5%	5—6	5¾	Jan. 27	...	Jan., July.	82	37
60,007	1	London Motor Omnibus Ord.	...	1/4	...	...	...	...	...	9½	4½
40,000	5	Do. do. 6% Cum. Pref.	...	2/2	...	...	...	...	...	...	...
74,000	6	London Road Car...	40	6	2¾—2⅞	50/-	Jan. 5	...	Feb., Aug.	3¼	2 3/16
5,471	10	Do. 5% Cum. Pref.	...	5/7¼	6—8	...	...	6 5 0	Feb., Aug.	...	...
31,000	4	London Street Tramways	...	2/-	⅜—½	...	..	...	*Mar.*	11/16	⅜
125,000	10	London United Tramways (1901), Ltd., 5% Cum. Pref. ...	3	5	7½—8½	7 13/16	Jan. 29	5 17 9	*Jan.*, July.	9½	7¾
22,900	5	Manx Electric Railway 5½% Cum Pref.	5½	5½	4½—5	...	...	5 10 0	June, Dec.	5⅛	4⅝
314,016	1	Metropolitan Electric Tramways Def.	..	...	1/16—3/16	1/3	Jan. 28	Nil		3/16	1/16
500,000	1	Do. do. do. 5% Cum. Pref.	6d.	6d.	13/16—15/16	16/9	Jan. 28	5 6 9	*Feb.*, Aug.	1	¾
87,500,000	$100	Mexico Tramways Gen. Con. 1st Mt. 5% Gold Bonds	...	5%	84—86%	85	Jan. 30	5 19 3	Mar., Sept.	86	79
50,000	5	New General Traction 6% Cum. Pref.	...	6/-	¾—1¾	...	...	...	Jan., *July.*	1¾	¾
110,923	4½	North Metropolitan Tramways	...	1/-	⅛—⅜	4/4½	Jan. 20	...	...	...	...
5,000	10	Oldham, Ashton, and Hyde Electric Tramways Ord.	7/-	5/-	8¼—8½	...	...	7 1 3	...	...	...
5,000	10	Do. do. do. do. 5% Cum. Pref.	5%	for '06	8—8¼	...	...	6 1 3	...	...	...
100,000	1	Perth (W.A.) Electric Tramways Ord.	5	1/-	9/16—11/16	...	...	7 5 6	*Mar.*	11/16	9/16
245,000	1	Potteries Electric Traction Ord.	4	4	9/16—11/16	...	...	7 2 3	*Mar.*	⅝	⅜
245,000	1	Do. do. 5% Cum. Pref.	6	6	9/16—11/16	...	...	7 5 6	*Feb.*, Aug.	11/16	½
24,912	10	Provincial Tramways Ord.	3/-	5/-	4½—5	...	...	8 0 0	*Dec.*	5½	4½
10,000	10	Do. do. 6% Cum. Pref.	6/-	6/-	9½—10½	9½	Jan. 23	5 14 3	June, *Dec.*	11	10¼
30,000	5	Rangoon Electric Tramways and Supply Co. 6% Cum. Pref.	...	3/-	5—5½	5¾	Jan. 30	5 9 3	June, Dec.	5¾	5
85,000	$100	San Paulo Tramway, Light, and Power	...	$2¼	120—124	122½	Jan. 30	6 16 0	*Apr.*, Oct.	144½	101
6,343	10	Snowdon Mountain Tramroad Ord.	...	...	7—8	...	...	...	...	...	...
169,570	1	South Metropolitan Elec. Trys. & Lighting Co. 6% Cum. Pref.	...	6¾d.	15/16—1 1/16	...	...	5 13 0	Feb., Aug.	1 3/32	⅞
3,900	5	Southport Tramways	4/-	...	3—3½	...	...	...	...	...	...
30,000	5	Stage Omnibus 5½% Cum. Pref.	...	2/9	½—1	...	...	...	*Jan.*, July.	1½	¾
40,000	5	Yorkshire (West Riding) Electric Tramways Ord.	...	...	1—1½	...	...	...	*Mar.*	1 9/16	1
46,261	5	Do. do. do. do. 6% Cum. Pref....	...	...	3¼—3¾	72/6	Jan. 22	...	*Mar.*	4	3⅛

ELECTRIC RAILWAY SHARES.

1,853,610£	Stk.	Central London Ord. Stock	4	3	65—68	67½	Jan. 30	6 3 9	*Feb.*, Aug.	82¼	54½
1,480,000£	Stk.	City and South London Cons. Ord. Stock	2	2½	42—44	44	Jan. 30	4 15 0	*Feb.*, Aug.	50½	39
78,000	10	Great Northern and City Pref. Ord. 4%	4	4	1¼—1¾	...	..	...	*Feb.*, Aug.	3¼	1⅛
159,000	10	G.N., Piccadilly, and Brompton Ord.	4	4	4—5	...	...	8 0 0	*Feb*, Aug.	8	4
500,000	10	Liverpool Overhead Ord.	—	—	1¾—1½	...	...	3 9 0	*Feb.*, Aug.	2	1¼
1,412,263£	Stk.	Mersey Cons. Ord. Stock	—	—	2—4	...	...	Nil	*Feb.*, Aug.	7	2
5,732,062£	Stk.	Metropolitan Cons.	½	½	38½—39½	38⅞	Jan. 30	2 13 9	*Feb.*, Aug.	60¼	51½
3,235,000£	Stk.	Metropolitan District Ord.	—	—	10—11	10¾	Jan. 29	Nil	*Feb.*, Aug.	19¼	7¼
2,499,200£	...	Unde ground Electric Railways Co. of London, Ltd., 5% Profit-sharing Secured Notes.	5	ann.	36—40	...	...	12 16 3	*June*, Dec.	89	54

* Date of final payment is given in italics.

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FINANCIAL REPORTS AND COMPANY MEETINGS.

New South Wales Tramways.—The New South Wales tramway revenue for the last quarter of 1907 was £280,427, compared with £232,517 for the corresponding quarter of 1906. The expenditure was £210,059, against £196,099.

Durban (Natal) Tramways.—During 1907 the total receipts were £85,392, the working expenses £51,031, and, after paying all charges, the net surplus was £2,236. The revenue from 11,493,288 passengers was equal to 16·67d. per car mile.

Liverpool Traffic Development.—At a meeting of the Liverpool Tramways Committee, on January 10, the traffic development in 1907 was announced. Last year the figures were: Receipts, £571,929 15s. 2d., an increase of £8,137 2s. 4d. or 1·59 per cent. over 1906; passengers carried, 124,043,239, an increase of 1,948,711 or 1·44 per cent.; mileage run, 12,231,799, an increase of 115,865 or ·95 per cent. The average earnings per car mile amounted to 11·22d., as against 11·17d., an increase of ·05d. The receipts exceeded those of 1905 by £21,809.

Rio de Janeiro Tramway, Light and Power Company.—The directors announce that, owing to increasing business in Europe, they have opened offices at 46, Threadneedle Street, London, E.C., and that the registers, etc., will be transferred on February 14 to the above address from the offices of the British Empire Trust Company, Limited, who have hitherto acted as secretaries and registrars in Europe. The company also announce that, owing to the pressure of other engagements, Mr. William Mackenzie, of Toronto, has resigned the presidency, but will remain chairman of the board. Dr. F. S. Pearson has been elected president, and Mr. R. M. Horne-Payne and Mr. E. R. Wood additional vice-presidents. Mr. George Flett (managing director of Dick, Kerr and Company, Limited), has also been elected an additional director.

Geneva Tramways Company (1906).—The report for the period from December 17, 1906, to September 30, 1907, sets out the scheme under which the assets of the Geneva Tramways Company (the old company) were sold to this company. It also states that the profit and loss account of the Swiss company shows a gross profit on working of 562,148 f., and, including the credit balance of 227,652 f. brought forward from the previous period, makes a total of 789,800 f.; and after making provision for the necessary contributions to amortisation, renewal, and reserve funds, amounting together to 179,332 f., there remained a balance of 610,467 f., out of which a dividend of 1½ per cent., amounting to 300,000 f., has since been paid, leaving a balance of 310,467 f. to be carried forward. Of the dividend of 300,000 f. above referred to, 299,940 f. has been received by this company in respect of its holding of shares in the Swiss company.

London Southern Tramways Company.—At an extraordinary meeting of this company, on January 3, Mr. W. M. Murphy, who presided, moved a resolution authorising the secretary to pay the shareholders £1 2s. 7d. per share, being the balance of the available funds realised by the sale of the company's undertaking to the London County Council. The chairman also reviewed the facts connected with the sale, as these were set out in the circular, already published, which was issued in December by Mr. J. Barber Glenn, the secretary and liquidator of the company. The amount now to be distributed, he pointed out, was a very small return for their £10 shares. It was, however, some gratification to the directors to have received a number of letters from shareholders expressing satisfaction with what the board had done in saving something out of the wreckage. The motion was adopted, and a vote of thanks was awarded to the chairman and the secretary for their services.

Burmah Electric Tramways and Lighting Company.—The report of the directors for the year ended July 31 last states that the receipts have barely covered the expenditure, in spite of the fact that the current expenses have not appreciably increased. During the year the plague continued with unabated activity, and about one third of the population left the city by reason of the epidemic, and the usual inflow of visitors ceased almost entirely, so that the directors consider the decrease in the receipts of about £1,000 is less than might reasonably have been expected. Since August last, when the plague was reported to have ceased, an improvement in the receipts has been manifested. In spite of their endeavours, the directors have been unable as yet to evolve any satisfactory solution to the fuel difficulty. No coal has yet made its appearance in Mandalay, and the company have still to rely upon wood for their heating power, and for this reason it has been impossible to effect any reduction in the charges for power, which continue abnormally high. The outlook seems generally to be more favourable.

Edinburgh and District Tramways Company.—The directors' report for the year ending December 31 shows that the total receipts were £264,872, an increase of £2,868 over the previous years. The working expenses and general charges amounted to £137,588, a decrease of £6,292 as compared with the previous year. After making provision for rent up to December 31, 1907, and also for interest on debentures, etc., there remains a balance of £24,960, which it is proposed to deal with as follows: Contribution to capital redemption fund for the years 1904 to 1907, with interest to December 31, 1907, £8,492; dividend on preference shares for the years 1904 to 1906, and half-year to June 30, 1907 (whereof one and a-half year's to June 30, 1905, was paid on August 1, 1907) at 5½ per cent. per annum, £14,437; writing off balance at debit of suspense expenditure account, £1,829; leaving £201 to be carried forward. The total receipts per car mile run were 10·55d., and the working expenses and general charges 5·48d., or including the corporation charges for rent, etc. (3·96d.), 9·44d. per car mile, leaving a profit of 1·11d. per car mile.

Dublin United Tramways Company.—The directors' report and accounts for the half-year ended December 31 last show that the total receipts were £177,503, compared with £125,146 in the corresponding half of 1906. The working expenses were £91,154, against £78,552, and the credit balance was £86,349, against £66,594. After payment of interest, etc., the amount available for division is £64,841, out of which it is provided that dividends be paid at the rate of 6 per cent. per annum free of income-tax on the ordinary shares, together with a bonus of 1s. per share also free of tax on the ordinary shares. It is proposed to set aside £5,000 to reserve and renewals fund, £1,000 to accident insurance fund, £10,000 towards reconstruction and maintenance, and £2,600 as further provision against the guarantee to the Irish International Exhibition, 1907. The remaining sum of £8,741 is carried forward. A year ago the dividends were at the same rate, but there was no bonus. The The number of passengers was 31,671,954, against 26,689,129, and the car mileage was 4,177,974, against 3,767,756. The working expenses, exclusive of some small miscellaneous items charged to revenue account, were equal to 5·107d. per car mile. The number of cars in stock is 311.

Metropolitan Railway Company.—The directors' report for the half-year ended December 31 last states that the total receipts amounted to £347,851, an increase of £3,776, and the expenses to £191,959, a decrease of £5,914. The net revenue account, after providing for prior charges and placing £6,000 to the depreciation fund, shows a balance of £19,846 available for the ordinary stock. After payment of a dividend at the rate of 10s. per cent. per annum on the ordinary capital, £5,516 remains to be carried forward, as compared with £5,822 a year ago, when nothing was placed to the depreciation fund. The number of passengers carried was 36,473,980, as against 37,605,020. The decrease is entirely in first and second class passengers. To meet very keen competition, a largely increased service of trains has been run, the electrical working now in full operation having rendered this extra service possible, without materially adding to the expenses. Referring to the new tube railways now in operation on certain routes the loss has been considerable, but the extra accommodation afforded has induced a large increase in the travelling habit of the people, and it is believed that the loss thus incurred will be soon balanced by gains in other directions. In conjunction with the Great Western Railway, it has been arranged to build a special station where the railway abuts on the site of the Franco-British Exhibition at Shepherd's Bush.

Sunderland District Electric Tramways.—At the third annual meeting of this company, held in London on December 30, Mr. C. S. Cockburn, the chairman, explained in detail the financial difficulties of the company, and pointed out that since the new management and policy had come into operation there had been a continuous increase in the traffic receipts. While the mileage run had been reduced by 1,000 car miles per week, the passengers had increased by 4,000 per week. Fifteen of the cars were French, and the cost of maintaining them was abnormal. The company had suffered from its early record. The power was at first supplied temporarily by a gas plant which was unreliable, so that the cars frequently stuck on the road. There had been two serious accidents at the same spot. A pilot driver was now permanently stationed at the dangerous place, and took charge of every car till it was passed. The directors' report was adopted. At a meeting of debenture holders, subsequently held, the chairman pointed out that the great bulk of the company's revenue was earned on Saturdays, Sundays, and Mondays, and, in order to give employment to all their drivers and conductors on the other days of the week, it was proposed to initiate a goods service, for which there was a field. Additional capital was needed for goods wagons, depôts, and sidings. The goods traffic should yield a profit of £2,000 a year, and the revenue from all sources would more than cover the interest on debentures and on a fresh loan. He explained the arrangements which were proposed for raising £20,000, and said he would welcome a committee to look into the matter and see that the money was properly spent. A resolution approving of the scheme was adopted, and a committee was appointed to confer with the board. An extraordinary meeting of the company was afterwards held, when resolutions were agreed to, authorising the directors to borrow £20,000 by the issue of prior lien bonds, repayable on or before January 1, 1918.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track). Mls.	Chs.	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Sinking Fund and Loans Repaid.	Depreciation, Renewal, and Reserve Funds.	Income. Traffic.	Other.	Total.
Aberdeen ...	May 31, 1907	Dec., 1899	E.	27	60	350,000	317,140	32,860	345,025	12,433	299,970	17,169	40,155	65,853	834	66,687
Ayr	May 15, 1907	Sept., 1901	,,	9	52	105,000	70,000	35,000	79,934	8,283	62,752	4,820	14,954	14,672	541	15,213
Birmingham ...	Mar. 31, 1907	Jan., 1904	,,	...		1,079,687	743,037	336,650	850,916	...	732,016	11,021	25,932	132,662	3,762	136,424
Blackburn ...	Mar. 25, 1907	Mar., 1899	,,	23	64	400,337	328,087	72,250	330,563	13,469	236,042	81,647	...	52,811	2,141	54,952
Blackpool ...	Mar. 31, 1907	June, 1899	,,	17 * 3	30 69	424,490	281,390	143,100	281,390	16,195	281,390	54,624	13,236	50,554	952	51,506
Bolton	Mar. 31, 1907	Dec., 1899	,,	42	42	632,760	528,027	104,733	471,760	11,093	377,482	71,801	48,622	110,935	359	111,294
Bradford ...	Mar. 31, 1907	July, 1898	,,	87 * 9	67 6	1,192,626	902,878	289,748	903,368	9,321	756,992	200,046	38,024	227,495	4,612	232,107
Brighton	Mar. 31, 1907	Nov., 1901	,,	17	15	279,070	274,070	5,000	274,905	15,994	257,186	20,885	3,165	48,898	1,755	50,653
Burnley	Mar. 31, 1907	Dec., 1901	,,	14 * 5	20 32	278,892	252,896	25,996	185,325	13,005	175,331	23,012	20,793	62,076	728	62,804
Burton-on-Trent	Mar. 31, 1907	Aug., 1903	,,	9	70	100,073	88,336	11,737	92,971	9,415	83,746	...	...	15,102	430	15,532
Bury	Mar. 31, 1907	June, 1903	,,	17 * 9	50 21	407,800	225,525	182,275	242,466	13,757	223,500	8,246	5,904	50,518	131	50,649
Chester	Mar. 25, 1907	April, 1903	,,	6	35	92,991	73,991	19,000	77,662	12,064	70,221	5,141	332	10,274	329	10,603
Chesterfield ...	Mar. 31, 1907	Dec., 1904	,,	5	68	95,000	68,528	26,472	68,529	11,714	65,000	2,557	...	10,989	503	11,492
Colchester ...	Mar. 31, 1907	July, 1904	,,	7	75	70,748	68,755	1,993	68,847	8,673	65,858	4,214	...	10,787	580	11,367
Croydon	Mar. 31, 1907	June, 1906	,,	19	44	336,611	254,010	82,601	270,043	13,813	224,234	35,276	...	61,091	975	62,066
Darlington ...	Mar. 31, 1907	June, 1904	,,	8	71	107,500	75,165	32,335	76,293	8,584	69,425	5,540	...	10,820	323	11,143
Darwen	Mar. 31, 1907	Oct., 1900	,,	7	13	93,400	85,400	8,000	85,436	11,928	73,879	13,658	1,150	13,327	681	14,008
Derby	Mar. 31, 1907	July, 1904	,,	E. 15 H.	1 ...	... ...	... ...	... ...	175,247 ...	... ...	159,722 ...	15,525 ...	... ...	E 37,558 H 4,184	871 147	38,429 4,331
Doncaster ...	Mar. 31, 1907	June, 1902	,,	10	42	92,500	84,200	8,300	84,735	8,051	79,300	5,727	...	12,030	337	12,367
Douglas (I.O.M.)	Mar. 31, 1907	..	H. C.	3 2	40 60	54,020	54,020	...	55,514	8,882	49,166	4,889	3,000	20,220	1,314	21,534
Dundee	May 15, 1907	July, 1900	E.	24	41	...	...	...	312,886	12,746	258,824	47,613	26,780	56,921	751	57,672
East Ham ...	Mar. 31, 1907	June, 1901	,,	12	61	160,442	160,133	309	164,064	12,855	146,323	20,775	3,442	46,435	653	47,088
Gloucester ...	Mar. 31, 1907	April, 1904	,,	12 * 2	41 39	151,000	126,000	25,000	127,326	10,186	123,333	3,993	...	14,192	841	15,033
Halifax	Mar. 31, 1907	June, 1898	,,	52	26	663,751	393,764	269,987	393,280	7,516	333,287	48,149	8,544	75,986	1,341	77,327
Ilford	Mar. 31, 1907	Mar., 1903	,,	11	28	142,603	142,396	207	142,396	12,546	129,549	13,054	6,532	24,478	912	25,390
Ipswich	Mar. 31, 1907	Nov., 1903	,,	14	70	116,471	110,000	6,471	114,334	7,687	106,098	4,674	...	21,262	780	22,042
Keighley	June 30, 1907	Oct., 1904	,,	6	9	50,934	46,004	4,930	46,004	7,526	39,891	6,827	1,641	8,019	222	8,241
Kilmarnock ...	May 15, 1907	Dec., 1904	,,	5	42	65,000	54,615	10,385	54,078	9,788	54,615	151	...	8,246	357	8,603
Kirkcaldy ...	May 15, 1907	Feb., 1903	,,	7	62	200,000	88,693	111,307	89,404	11,499	83,750	4,943	1,267	13,230	473	13,703
Lancaster ...	Mar. 25, 1907	Jan., 1903	,,	4	65	60,000	51,550	8,450	41,339	8,590	46,250	5,651	...	5,360	119	5,479
Leith	May 15, 1907	Aug., 1905	,,	11	76	225,000	171,345	53,655	179,796	15,046	179,062	6,873	...	26,380	643	27,033
Lincoln	Mar. 31, 1907	Nov., 1905	2	2	77	98,519	43,072	55,447	39,231	13,243	48,061	2,819	...	5,741	104	5,845
Liverpool ...	Dec. 31, 1906	Nov., 1898	E.	104	0	2,442,600	2,044,775	397,825	1,901,997	18,288	1,604,435	503,941	238,354	563,777	7,439	571,216
Lowestoft ...	Sep. 30, 1907	July, 1903	,,	5	79	129,230	79,231	49,999	79,231	13,233	75,135	5,076	...	10,937	349	11,286
Maidstone ...	Mar. 31, 1907	July, 1904	,,	2	23	25,000	25,000	...	26,255	11,477	25,005	1,250	2,000	5,650	241	5,891
Manchester ...	Mar. 31, 1907	June, 1901	,,	111 *43 †14	6 57 54	1,875,015	1,558,669	316,346	1,725,845	15,538	1,436,184	144,197	320,028	712,976	6,697	719,673
Nelson	Mar. 31, 1907	Feb., 1903	,,	3	69	38,000	35,662	2,338	35,662	9,233	33,291	2,371	...	7,264	55	7,319
Newport (Mon.) ...	Mar. 31, 1907	April, 1903	,,	14	40	264,500	189,819	74,681	199,424	13,753	180,461	18,003	1,046	32,547	652	33,199
Nottingham ...	Mar. 31, 1907	Jan., 1901	,,	35	58	730,300	581,734	148,566	581,734	16,284	473,128	116,340	53,668	137,998	1,995	139,993
Oldham	Mar. 25, 1907	May, 1902	,,	27 * 8	20 31	507,769	439,547	68,222	440,422	16,162	380,354	94,643	6,119	92,763	1,315	94,078
Perth	May 15, 1907	Nov., 1905	,,	8	40	70,000	73,400	...	74,879	8,809	70,450	3,710	...	7,985	411	8,396
Plymouth ...	Mar. 31, 1907	Sept., 1899	,,	15	0	182,856	174,906	7,950	215,986	14,399	132,872	45,355	29,126	31,256	10	31,266
Rochdale	Mar. 31, 1907	May, 1902	,,	24 * 5	45 26	354,491	345,000	9,491	343,246	13,974	345,000	16,231	...	53,830	308	54,138
Rotherham ...	Mar. 31, 1907	Jan., 1903	,,	10	0	228,550	112,500	116,050	123,914	12,391	104,040	8,517	9,181	26,917	819	27,736
Salford	Mar. 31, 1907	Oct., 1901	,,	36 *38	40 20	1,192,246	669,583	522,663	574,853	15,749	626,609	125,701	46,146	232,551	...	232,551
Southampton ...	Mar. 31, 1907	Jan., 1900	,,	16	22	202,539	172,397	30,142	200,183	12,300	164,242	35,659	690	49,636	1,368	51,004
Southport ...	Mar. 31, 1907	July, 1900	,,	10 * 8	61 78	292,000	196,500	95,500	195,412	9,930	157,230	39,270	6,773	18,176	307	18,483
South Shields ...	Mar. 31, 1907	Mar., 1906	,,	10	21	252,171	134,061	118,110	155,422	15,145	133,360	7,653	2,531	23,992	46	24,038
Stalyb'ge, Hyde, Mossley, & D'k'f'd	Mar. 31, 1907	May, 1904	,,	27	57	325,270	259,470	65,800	258,177	9,318	244,028	15,442	...	38,766	39	38,805
Sunderland ...	Mar. 31, 1907	Aug., 1900	,,	19	40	304,086	294,461	9,625	289,691	14,825	233,485	52,094	...	72,054	342	72,396
Wallasey ...	Mar. 31, 1907	Mar., 1902	,,	12	55	140,436	138,150	2,286	138,917	10,950	127,918	10,723	18,592	42,254	630	42,884
Walsall	Dec. 31, 1906	Dec., 1902	,,	15 * 2	2 5	188,144	151,000	37,144	142,947	8,366	145,900	6,162	...	26,400	546	26,946
Warrington ...	Mar. 31, 1907	April, 1902	,,	9	52	128,050	100,446	27,604	101,615	10,530	89,721	10,831	1,530	19,204	336	19,540
West Ham ...	Mar. 31, 1907	Feb., 1904	,,	26	35	509,119	353,753	155,366	547,989	20,728	531,494	11,822	19,548	116,793	2,982	119,775
Wigan	Mar. 31, 1907	April, 1901	,,	24	70	461,570	459,670	1,900	515,212	20,712	465,985	55,168	...	61,101	1,368	62,469
Wolverhampton	Mar. 31, 1907	April, 1902	2	20 * 4	0 40	279,228	245,861	33,367	254,606	12,730	227,359	17,260 Motor O	18,051 mnibuses	43,183 2,375	640 45	43,823 2,420
Yarmouth (Gt.) ...	Mar. 31, 1907	June, 1902	E.	12	4	144,500	110,000	34,500	110,363	9,159	101,791	5,424	1,197	21,390	512	21,902

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast	Mar. 31, 1907	Nov., 1905	E.	73	18	1,225,448	1,060,000	165,448	1,115,784	15,232	1,060,000	22,256	13,000	177,832	3,307	181,139
Bexley	Mar. 31, 1907	Oct., 1903	,,	6	73	98,259	96,984	1,275	94,858	13,723	90,854	6,130	...	11,419	1,569	12,988
Birkenhead	Mar. 31, 1907	Feb., 1901	,,	23	79	366,266	357,854	8,412	357,991	14,914	306,891	50,964	11,025	54,252	1,156	55,408
Bournemouth ...	Mar. 31, 1907	July, 1902	,,	34 *10	35 0	381,554	381,554	...	401,668	11,664	368,221	35,518	24,999	83,663	360	84,023
Cardiff	Mar. 31, 1907	May, 1902	,,	36	50	802,039	732,383	69,656	767,109	20,948	689,467	73,808	9,277	106,551	12,564	119,115
Glasgow	May 31, 1907	Oct., 1898	,,	165 * 10	47 55	3,100,000	2,227,353	872,647	3,104,061	18,746	1,679,974	547,379	1,122,104	887,381	8,461	895,842
Huddersfield ...	Mar. 31, 1907	Feb., 1901	,,	33 * 3	0 20	646,284	398,957	247,327	412,902	12,512	325,819	82,507	44,360	78,115	3,081	81,196
Hull	Mar. 31, 1907	July, 1899	,,	27	15	488,673	436,543	52,130	436,543	16,057	436,543	67,357	74,775	121,186	...	121,186
Leeds	Mar. 31, 1907	Aug., 1897	,,	96	50	1,340,374	1,340,374	...	1,303,815	13,494	1,167,263	213,248	33,270	323,913	3,891	327,794
Leicester	Dec. 31, 1906	May, 1904	,,	37	0	734,838	678,805	56,033	677,829	18,320	651,645	46,672	41,448	114,752	1,776	116,528
London	Mar. 31, 1907	May, 1903	1	H100 E116	6 55	*	*	*	6,736,737	31,077	6,133,564	603,173	141,855	567,694 810,320	15,296 14,676	582,990 824,996
N'castle-on-Tyne	Mar. 31, 1907	Dec., 1901	E.	53 *6	0 10	1,413,989	1,164,028	249,961	1,150,701	21,711	1,029,992	152,476	43,515	205,262	3,392	208,654
Northampton ...	Mar. 31, 1907	July, 1904	,, H.	9 ...	6 ...	128,300 ...	127,255 ...	1,045 ...	127,374 ...	14,036 ...	115,546 ...	11,709 ...	2,113 ...	21,542 770	542 88	22,084 858
Portsmouth ...	Mar. 31, 1907	Sep., 1901	E.	28	40	672,272	661,714	10,558	670,157	23,514	618,341	100,715	48,695	98,911	3,103	102,014
Preston	Mar. 31, 1907	June, 1904	,,	17	16	224,102	187,269	36,832	187,269	10,888	167,775	14,487	9,907	37,796	150	37,946
Reading	Mar. 31, 1907	July, 1903	,,	13	15	231,658	231,658	...	220,783	16,742	204,933	22,548	7,466	32,661	972	33,633
Sheffield	Mar. 25, 1907	Sep., 1899	,,	56	28	1,163,646	1,133,770	29,876	1,172,279	17,683	970,620	136,278	74,245	276,907	2,679	279,586

E—Electric trolley system. H—Horse lines. C—Cable lines. * Indicates lines leased. † Lines on which running powers are exercised.
1 Horse, conduit, and electric. 2 Surface contact.
* Conferred by Annual Money Act, which limits amount for each financial year. Powers not exercised are lapsed.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name	Operating Expenses.					Net Income.	Additions to Net Income.	Deductions from Net Income.						Net Surplus + or Deficit −
	Traffic.	General.	Repairs & Maintenance.	Power.	Total.			Interest.	Sinking Fund.	Income Tax.	Depreciation & Renewal	Sundries.	Total.	
Aberdeen	16,734	6,548	6,008	9 361	38,651	28,036	4,134	10,985	3,515	...	16,737	933	32,170	...
Ayr	3,295	1,813	1,150	2,005	8,263	6,950	70	2,400	958	303	2,367	...	6,028	+ 992
Birmingham	27,311	9,298	6,028	25,602	68,239	68,185	...	18,447	6,547	...	14,660	16,531	56,185	+ 12,000
Blackburn	11,779	3,016	7,373	11,018	33,186	21,766	...	7,583	12,878	448	...	345	21,254	+ 512
Blackpool	10,648	3,646	6,199	9,339	29,892	21,614	3,480	8,590	6,349	113	6,042	...	21,094	+ 4,000
Bolton	25,322	6,443	13,209	16,589	61,563	49,731	753	12,993	13,573	...	14,693	146	41,405	+ 9,079
Bradford	62,245	19,909	31,785	45,644	159,583	72,524	3,232	25,020	29,484	2,543	4,536	4,173	65,756	+ 10,000
Brighton	13,047	3,652	6,558	11,243	34,500	16,153	...	8,579	5,164	...	...	...	13,743	+ 2,410
Burnley	14,251	4,833	6,971	15,237	41 292	21,512	...	5,855	4,834	...	8,766	2,057	21,512	...
Burton-on-Trent	4,738	1,634	1,721	2,845	10,938	4,594	418	2,004	1,978	...	1,000	907	5,889	− 877
Bury	11,719	3,877	4,018	8,471	28,085	22,564	244	7,658	5,253	385	2,500	6,002	21,798	− 1,715
Chester	2,752	1,309	506	1,946	6,513	4,090	...	2,436	1,287	..	367	...	4,690	...
Chesterfield	2,691	635	769	1,882	5,977	5,515	...	4,060		133	...	...	4,193	+ 1,322
Colchester	3,669	1,285	1,169	3,117	9,240	2,127	...	2,485	1,732	...	...	...	4,217	− 2,090
Croydon	17,515	4,862	6,798	12,597	41,772	20,294	401	6,238	4,804	600	9,053	...	20,695	...
Darlington	3,551	671	881	2,235	7,338	3,805	35	2,437	1,941	...	...	...	4,398	− 558
Darwen	3,208	731	1,900	2,780	8,619	5,389	...	2,407	2,048	...	1,050	...	5,505	− 116
Derby	E 11,179 H 1,497	2,043 163	2,055 337	7,111 2,929	22,388 4,926	16,041 ...	548	5,657	2,387	...	...	615	8,659	+ 7,930
Doncaster	3,509	994	1,634	3,597	9,734	2,633	...	2,651	1,249	95	...	...	3,995	− 1,362
Douglas (I.O.M.)	4,019	1,756	2,546	5,322	13,643	7,891	...	1,959	885	...	2,000	2,650	7,494	+ 397
Dundee	14,020	3,748	6,138	11,498	35,404	22,268	...	8,236	5,330	300	8,316	...	22,182	+ 86
East Ham	12,901	3,039	6,185	6,847	28,972	18,116	583	5,632	5,054	248	...	2,599	13,533	− 104
Gloucester	5,472	1,402	1,527	2,654	11,055	3,978	...	5,363	2,259	...	...	836	8,458	− 4,480
Halifax	19,530	7,616	11,776	18,960	57,882	19,445	1,180	12,782	8,588	457	...	475	22,302	− 1,677
Ilford	8,206	2,430	2,207	4,286	17,129	8,261	1,666	4,804	3,949	...	792	382	9,927	...
Ipswich	7,645	1,732	2,249	4,501	16,127	5,915	...	4,157	1,753	...	...	...	5,910	+ 5
Keighley	2,523	548	465	1,656	5,192	3,048	90	1,331	1,554	...	253	...	3,138	...
Kilmarnock	2,990	747	638	1,925	6,300	2,303	...	1,886	151	19	...	652	2,708	− 405
Kirkcaldy	4,330	822	720	3,212	9,084	4,619	...	2,916	2,103	...	409	184	5,612	− 993
Lancaster	2,264	863	673	1,823	5,623	...	90	1,554	1,229	...	...	* 144	...	− 2,837
Leith	8,883	2,482	2,368	4,153	17,886	9,137	62	5,906	6,873	...	...	150	12,929	− 3,729
Lincoln	1,436	844	522	1,027	3,829	2,016	...	1,150	1,368	...	...	...	2,518	− 502
Liverpool	148,668	54,452	82,367	99,918	385,405	185,811	12,403	53,244	56,337	...	55,171	5,877	170,629	+ 27,585
Lowestoft	3,658	859	1,418	3,180	9,115	2,171	...	2,607	1,332	...	...	...	3,939	− 1,768
Maidstone	1,352	656	514	1,509	4,031	1,860	122	983	625	...	...	...	1,608	+ 374
Manchester	196,785	63,374	63,270	131,264	454,693	264,980	1,911	50,141	39,594	4,769	87,827	29,560	211,891	+ 55,000
Nelson	2,111	383	868	2,105	5,467	1,852	...	1,072	765	76	...	...	1,913	− 61
Newport (Mon.)	7,423	3,039	4,927	6,488	21,877	11,322	2,184	7,838	4,140	99	45	...	12,122	+ 1,384
Nottingham	33,457	12,553	12,563	22,483	81,056	58,937	...	15,889	16,493	...	...	2,811	35,193	+ 23,744
Oldham	20,089	4,317	8,148	21,582	54,136	39,942	1,110	12,436	13,227	277	.	6,447	32,387	+ 8,665
Perth	2,505	677	140	1,741	5,063	3,333	47	2,634	1,892	2	...	...	4,528	− 1,148
Plymouth	6,811	2,728	5,153	7,170	21,862	9,404	1,225	4,624	4,727	...	...	1,278	10,629	...
Rochdale	13,656	2,323	4,361	9,165	29,505	24,633	...	10,448	6,907	772	...	3,613	21,740	+ 2,893
Rotherham	7,566	2,215	2,171	6,899	18,851	8,885	1,463	3,737	2,260	...	4,201	150	10,348	..
Salford	61,281	14,543	21,165	45,177	142,166	90,385	4,439	20,452	18,691	1,446	14,889	26,346	81,824	+ 13,000
Southampton	14,032	4,495	7,024	11,019	36,570	14,434	...	6,222	5,192	212	2,535	273	14,434	...
Southport	4,508	1,648	1,832	3,238	11,226	7,257	6,325	6,434	4,946	...	1,977	150	13,507	+ 75
South Shields	5,038	1,852	988	4,260	12,138	11,900	111	4,504	2,859	...	2,531	2,117	12,011	...
Stalybridge, Hyde, Mossley, & D'kinf'd	14,906	3,737	4,117	9,180	31,940	6,865	...	8,949	6,115	...	...	...	15,064	− 8,199
Sunderland	18,417	5,406	4,159	12,840	40,822	31,574	704	8,751	9,014	469	6,259	661	25,154	+ 7,124
Wallasey	11,716	3,190	3,346	8,914	27,166	15,718	221	4,873	2,634	...	3,000	553	11,060	+ 4,879
Walsall	6,849	2,418	2,862	3,965	16,094	10,852	1,053	5,099	2,148	269	4,389	...	...	...
Warrington	4,996	1,460	2,178	3,813	12,447	7,093	127	3,195	2,715	...	...	...	5,910	+ 1,310
West Ham	39,667	7,858	9,084	15,810	72,419	47,356	162	14,902	7,444	650	7,722	2,810	33,528	+ 13,990
Wigan	15,416	8,038	10,560	14,807	48,821	13,648	...	18,450	10,260	...	...	1,330	30,040	− 16,392
Wolverhampton	780 10,014	116 3,313	858 3,793	409 7,417	2,154 24,537	266 19,286	... 719	... 7,808	... 4,130	... ...	... 5,783	... 359	... 18,080	... + 2,191
Yarmouth (Gt.)	6,547	1,859	1,922	3,942	14,270	7,632	...	3,376	1,962	...	...	...	5,338	+ 2,294

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTIOH AHD LIGHTINC PURPOSES.

Belfast	54,732	12,296	20,277	15,953	103,258	77,881	111	34,339	21,175	...	13,000	...	68,514	+ 9,478
Bexley	3,229	1,314	1,645	2,658	8,846	4,142	127	3,132	1,810	...	...	...	4,942	− 673
Birkenhead	15,049	5,092	7,506	5,858	33,505	21,903	...	11,891	9,289	200	317	206	21,903	...
Bournemouth	22,562	6,175	10,134	14,570	53,441	30,582	1,874	12,185	12,756	...	...	6,664	31,425	+ 1,031
Cardiff	36,893	9,384	11,802	7,094	65,174	49,185	...	23,138	19,729	...	...	1,913	44,780	+ 4,405
Glasgow	245,021	86,791	122,126	31,318	485,256	410,586	3,510	63,769	49,777	9,932	168,408	51,931	343,817	+ 70,279
Huddersfield	18,959	3,931	12,086	5,065	40,041	41,155	303	12,185	9,808	806	12,427	1,206	36,432	+ 5,026
Hull	30,592	8,933	21,301	9,352	70,178	51,008	818	12,942	9,528	1,224	10,604	...	34,298	+ 17,528
Leeds	87,112	29,403	37,440	17,255	171,210	156,584	9,512	43,005	38,029	3,946	11,481	373	96,834	+ 69,262
Leicester	41,903	8,823	10,057	8,157	68,940	47,588	551	22,761	11,872	396	13,110	...	48,139	...
London	H 202,483 E 213,906	69,981 88,654	52,221 84,065	259,683 81,478	584,368 468,103	... 356,893	... 4,424	174,778	153,155	1,425	35,000	22,285	386,643	− 28,326
N'castle-on-Tyne	56,004	16,536	20,482	13,060	106,882	102,572	3,071	34,323	34,255	4,366	335	3,924	75,959	+ 28,440
Northampton	E 5,763 H ...	1,894 ...	1,339 ...	2,290 ...	11,286 1,245	10,798 ...	110 ...	... 4,353	... 3,728	... ...	... 1,355	... 472	... 9,908	... + 1,000
Portsmouth	26,501	7,660	6,029	5,565	45,755	56,259	353	19,697	16,217	1,109	6,261	4,303	47,587	+ 9,025
Preston	10,071	4,505	4,004	2,203	20,783	17,163	...	5,822	5,773	...	5,568	...	17,163	...
Reading	8,515	3,725	2,618	3,405	18,263	15,370	...	6,558	5,607	145	3,060	...	15,370	...
Sheffield	97,590	20,245	29,662	20,922	168,419	111,167	812	41,393	25,716	2,203	20,000	2,000	91,312	+ 20,667

H—Horse lines. E—Electric trolley lines. * Deficit on Revenue Account.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBIHED GENERATING STATION FOR TRACTION AND LICHTIHC PURPOSES.

Name.	Appropriation of Net Surplus. Carried Forward.	Reserve.	Relief of Rates.	Population Served.	Car Mileage.	Passengers Carried.	Passengers Carried per Car Mile.	Average Fare per Passenger. d.	Average Journeys per Head of Populat'n per Annum.	Average Car Miles per Day per Car.	Average Total Revenue per Car Mile. d.	Average Traffic Revenue per Car Mile. d.	Traffic Revenue per Mile of Single Track.	Average Traffic Revenue per Annum per Head of Populat'n Served.	Operating Expenses per Passenger. d.	Percentage of Operating Expenses to Total Revenue. %
Aberdeen ...	..	...	...	167,000	1,529.682	17,676,008	11·55	·95	105·84	35	11·112	10·332	2.522	8/4	·52	54·37
Ayr... ...	..	992	...	33,000	378,884	3,603,789	9·51	·98	109·20	104	9·637	9·294	1,520	8/11	·55	54·31
Birmingham ...	12,000															
Blackburn ...	512	...	...	200,000	1.002.372	10,094,028	10·07	1·25	50	105	13·15	12·64	2,219	5/3	·80	61·01
Blackpool ...	...	...	4,000	...	958.836	8,304,218	8·66	1·58	...	109	12·89	12·65	2.380	...	·864	58·04
Bolton	...	...	9,079	221,000	2,411,969	23,410,690	9·70	1·14	105·93	111·21	11·07	11·03	2,650	10/5	·63	53·40
Bradford	...	...	10.000	324,000	5.167,261	46,728.977	9·043	1·17	144	104·09	10·78	10·566	2,347	11/5	·819	63·76
Brighton	2,410	...	...	128,095	1.118.800	10,759,310	9·62	1·09	84	87·68	10·86	10·49	2,844	7/8	·77	68·11
Burnley	...	...		165,000	1,205.830	11,967,498	9·92	1·31	73	100	12·50	12·35	3,159	7.6	·83	65·86
Burton-on-Trent	...	...		52,000	421.317	3,383,527	8·03	1·072	65	58	8·85	8·60	1,529	5/10	·78	70·42
Bury	...	...	2.725	124,726	1,276,227	9,944,897	8	1·22	79·73	123·33	9·525	9·500	1,854	8/1	·677	53·45
Chester	...	...	...	38 300	291.555	2,532,778	8·687	·97	66·12	92	8·731	8·460	2,854	5/4	·62	63
Chesterfield ...	922	...	400	38,000	275.417	2,302,097	8·36	1·13	60	125	10·01	9·58	1,900	5/9	·62	53
Colchester ...	...	...	...	40,540	353,331	2,514,589	7·11	1·02	62·02	86	7·721	7·327	1,522	5/4	·88	81·5
Croydon	...	...	...	154,342	1.502,408	13,514,918	8·99	1·08	87·56	103	9·915	9·70	3,125	7/11	·742	66·87
Darlington ...	...	...	...	50.000	372.912	3,169,036	8·5	·82	63·38	92·9	7·171	6·964	1,217	4/4	5·[illegible]	65·86
Darwen	...	...	...	41,864	240.893	2,562.234	10·63	1·2	61	71·09	13·956	13·277	1,861	6/4	·807	61·53
Derby	7,930	...	...	124,000	E. 849,248 H. 100.093	8,381,460 1.004.914	9·869 9·222	1·075 ·999	75·70	...	10·86 9·529	10·614 9·205	...	6/9	·64 1·17	55·26 113·71
Doncaster ...	...	...	...	41,500	495.404	2,753.506	5·55	1·05	66·35	122	5·991	5·828	1,143	5/9	·85	78·71
Douglas (I.O.M.)	397	...	...	...	H. 285,513 C. 121,333	2,161,667 700,227	7·017	1·696	...	70 Sum. 79 ,,	12·672	11·899	3,235	...	1·144	63·36
Dundee	..	86	...	164,500	1,162,792	15,554,905	13·3	·878	93	81	11·905	11·748	2,323	6/11	·546	61·38
East Ham ...	...	...	5,270	125,000	1,062,151	15,049,240	14·1	·74	120	108	10·64	10·492	3.638	7/5	·50	61·53
Gloucester ...	...	...	...	50,715	519,996	3,182,111	6	1·06	62·75	94·93	6·938	6·55	948	5/7	·83	73
Halifax	...	...	...	178,000	1,624,275	18,899,242	11·62	·97	106	78	11·425	11·228	1.474	8/6	·735	74·85
Ilford	...	...	...	70,000	645,117	6,586,754	10·2	·89	94	126	9·446	9·106	2.156	7/-	·624	67·46
Ipswich	5	...	...	73,000	654,253	5,289,006	8·08	·965	75·56	70·65	8·086	7·8	1,429	5/10	·73	73·16
Keighley	...	...	...	42,000	256,715	1.935,098	7·50	·994	46·07	100·41	7·704	7·497	1.312	3.10	·644	62
Kilmarnock ...	...	...	...	36,000	328,829	2,331,277	7·09	·84	64·76	98·80	6·279	6·018	1.492	4/7	·654	73·75
Kirkcaldy ...	...	...	...	34,063	466,919	4,640,618	9·939	·692	136·2	53	7·556	7·289	1.734	7/9	·47	66·29
Lancaster ...	...	...	...	44,600	194,577	1.353,681	6·96	·950	30·35	92	6·759	6·611	1.117	2/5	·997	108
Leith	...	...	...	113,251	861,162	8,519,563	9·9	·74	75·23	112	7·531	7·352	2,208	4·8	·504	66·22
Lincoln	...	...	...	52,500	137,186	1,437,946	10·48	·95	27·39	55	10·226	10·044	1,938	2·2	·64	65·50
Liverpool ...	...	...	27,585	770,000	12,115.934	122,094,528	10·07	1·108	158·56	106	11·315	11·188	5,421	14/8	·766	67
Lowestoft ...	...	...	...	31,000	343.190	2.622,922	7·64	1·00	84·61	67	7·89	7·65	1,827	7/-	·83	87·64
Maidstone ...	374	...	...	13,000	157,050	1,186,566	8·85	1·14	91·27	92·5	9·002	8·633	710	8/8	·81	68·44
Manchester ...	...	...	55,000	800,000	15,523,459	143,264,501	9·23	1·19	179	100	11·12	11·02	4,556	17/10	·76	63·18
Nelson	...	...	...	42,000	203,203	2,035,300	10·01	·86	48·46	93	8·645	8·580	1,881	3/5	·645	74·70
Newport (Mon.)...	1,384	...	...	75,000	772,753	7,760,404	10·04	1·007	100·81	100	10·311	10·108	2,245	8/8·15	·677	65·90
Nottingham ...	...	6,744	17,000	254,568	2,731,552	31,218,691	11·43	1·06	123	95·50	12·30	12·13	3,863	10/10	·62	58
Oldham	...	3,665	5,000	160,000	1,818,444	18,647,731	10·25	1·19	116·55	104	12·416	12·213	2,604	11/7	·697	57·54
Perth	...	...	...	34,000	229,551	1,681,188	7·32	1·14	49·45	91	8·779	8·349	939	4 8	·723	60·3
Plymouth ...	..	...	...	118,000	721,115	7,324,347	10·157	1·024	62·07	90	10·406	10·403	2,084	5 4	·72	69·92
Rochdale	2,893	...	...	102,614	1,201,364	9,749,202	8·11	1·32	95	105	10·814	10·753	1,804	10 6	·73	55
Rotherham ...	...	...	...	61,500	618,211	5,743,298	9·29	1·125	93·39	109·56	10·767	10·450	2,692	8/9	·788	67·97
Salford	...	...	13,000	350,000	5,268,933	43,614,123	8·27	1·27	124·6	115·5	10·594	10·594	3,102	13 3	·782	59·99
Southampton ...	...	...	...	117,300	1,143,085	9,437,396	8·256	1·251	80	70	10·709	10·421	3,050	8/6	·93	71·70
Southport ...	75	...	...	31,312	447,821	4,068,131	9·08	1·07	129·9	102·5	9·905	9·741	1,691	11/7	·66	60
South Shields ...	...	...	...	112,000	659,948	5,654,929	10·09	1·01	50·48	99	10·30	10·28	2,337	4·3	·515	50·59
Stalybridge, &c.	...	...	...	92,811	1,422,122	9,780,464	6·877	·951	101·88	95·03	6·548	6·542	1,399	8/4	·784	82·3
Sunderland ...	...	...	7,124	170,000	1,535,425	17,483,132	11·38	1·006	102	76·8	11·314	11·261	3,687	8/6	·56	55·66
Wallasey ...	1,539	...	3,340	65,000	862,123	7,935,451	9·27	1·27	123	81·4	11·94	11·76	3,330	13/-	·816	62·60
Walsall	...	...	...	100,000	611,687	4,814,657	7·592	1·316	48	102	10·572	10·358	1,955	5·3	·82	59·727
Warrington ...	...	1,310	...	83,000	429,786	4,965,296	11·55	·93	59·82	103·42	10·911	10·724	1,989	4/7	·60	63·7
West Ham ...	4,322	...	9,668	308,284	2,556,884	35,502,836	13·88	·789	115	87	11·243	10·963	5,159	7/7	·492	60·00
Wigan	...	...	...	61,000	1,452,458	11,269,947	7·76	1·26	185	83	10·32	10·09	2,456	20/-	1·04	78
Wolverhampton	2,191	...	...	100,900	966,133	9,276,023	9·601	1·179	91·93	90	10·886	10·727	1,763	9/-	·691	57·72
Yarmouth (Gt.)...	2,294	...	...	35,000	601,535	4,296,953	7·143	1·199	122·77	73·97	8·737	8·534	1,775	12/3	·798	65·15

TABLE II.—TOWNS WITH SEPARATE GEHERATING STATIONS FOR TRACTION AND LICHTING PURPOSES.

Belfast	516	..	8,962	349,180	5,296,895	42,945,849	8·11	·99	123	128	8·21	8·06	2,473	10/4	·58	57
Bexley	...	...	...	16,300	268,619	1,737,204	6·46	1·70	106·58	...	11·604	10·202	1,652	14/-	1·22	68·11
Birkenhead ...	...	...	...	117,000	1,324,743	11,696,691	8·82	1·113	100·83	83·32	10·038	9·829	2,261	9/3	·687	60·84
Bournemouth ...	1,031	...	...	100,000	1,765,098	13,503,610	7·65	1·48	135	92	11·42	11·37	2,860	16/9	·95	63·65
Cardiff	4,405	...	...	164,333	2.624,504	24,438,164	9·31	1·046	148·71	99	10·893	9·744	2,910	12/11	·653	55·83
Glasgow	...	25,279	45,000 *	1,050,000	20,350,367	224,063,098	11·01	·95	213	101·20	10·565	10·465	5,035	16/11	·52	53·96
Huddersfield ...	5,026	...	...	120,000	1,794,691	15,252,150	8·50	1·22	127	112	10·79	10·38	2,770	13/-	·63	49·32
Hull	15,000	...	2,528	266,762	2,956,406	29,151,543	9·86	1·00	109	113·68	9·84	9·84	4,456	9/1	·58	57·89
Leeds	...	...	69,262	463,495	7,454,321	73,024,853	9·92	1·065	157·55	111·38	10·69	10·56	3,352	14/-	·563	52·23
Leicester	...	...	...	232,111	3.331.998	27,467,984	8·243	1·002	118	99	8·393	8·265	3,101	9/11	·60	59
London	...	...	...	...	H 13,862,718 E 16,267,579	131,165,027 183,062,063	9·46 11·25	1·04 1·06	... ...	82 106	10·093 12·171	9·828 11·955	5,762 6,944	... ...	1·069 ·614	100·24 56·74
N'castle-on-Tyne	...	14,856	13,584	300,000	4,263,174	45,506,468	10·67	1·11	152	106	11·75	11·56	3,871	13/8	·57	50·84
Northampton ...	... ...	... ...	1,000 ...	90,000 ...	E. 541,715 H. 31.864	5,216,883 184,072	9·63 7·77	·99 1·00	60 ...	90 ...	E. 9·78 H. 6·46	9·53 5·80	2,459 ...	4/11 ...	·519 1·624	E. 51·10 H. 145·27
Portsmouth ...	4,025	...	5,000	202.000	2,199,823	20,668,825	9·40	1·15	102·32	83	11·129	10·791	3,471	9/9	·531	44·85
Preston	...	...	...	120,000	904,582	8,459,742	9·35	1·072	70·5	132·92	10·068	10·028	2,197	6,3	·59	54·77
Reading	...	...	...	80,000	918.825	8.130,179	8·84	·96	110	112	8·78	8·53	2,476	7/10	·53	54
Sheffield	...	...	20,667	447,951	6,804,656	73,966,299	10·870	·898	165	104·6	9·861	9·767	4,174	12·4	·546	60·24

* Applied as special depreciation. H—Horse lines. E—Electric trolley system.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Average Operating Expenses per Car Mile (excludi'g Power Cost). d.	Average Operating Expenses per Car Mile (including Power Cost). d.	Average Number of Cars in Use Daily.	Number of Cars in Stock.	Average Speed per Hour. Miles.	Average Car Hours per Day.	Average Distance of 1d. Fare. Miles.	Average Fare Charged per Mile. d.	Operating Expenses per Car Mile. Traffic. d.	General. d.	Repairs and Maintenance. d.	Power. d.	Total. d.	Board of Trade Units.	Cost per Board of Trade Unit. d.	Board of Trade Units used per car mile.
Aberdeen	4·595	6·064	44	69	7	704	1·31	·81	2·625	1·027	·943	1·469	6·064	1,906,218	1·17	1·25
Ayr	3·964	5·234	10	19	8	130	1·26	·75	2·087	1·148	·729	1·270	5·234	375,436	1·28	·99
Birmingham ...																
Blackburn	5·38	8·02	26	48	7·50	364	1·25	·76	2·82	·72	1·76	2·64	7·94	1,853,272	1·43	1·84
Blackpool	5·13	7·48	24	61	6	400	...	...	2·67	·91	1·55	2·35	7·48	1,261,946	1·79	1·31
Bolton	4·47	6·12	58	96	7½	932	1·40	·70	2·518	·639	1·313	1·656	6·126	3,619,390	1·10	1·50
Bradford	5·292	7·412	136	239	7·20	2,040	1·59	·501	2·891	·925	1·476	2·120	7·412	9,582,871	1·14	1·8
Brighton	4·99	7·40	32	50	6½	512	1·31	·72	2·799	·784	1·407	2·412	7·402	1,798,905	1·50	1·61
Burnley	5·18	8·218	27	46	7	405	1·25	·83	2·836	·963	1·387	3·032	8·218	2,525,135	1·45	2·06
Burton-on-Trent...	4·61	6·23	9·79	20	6¾	181	1·35	·70	2·70	·93	·98	1·62	6·23	551,758	1·385	1·16
Bury	3·689	5·282	..	47	7·56	...	1·22	·83	2·204	·729	·756	1·593	5·282	2,042,840	·99	1·6
Chester	3·762	5·364	6·4	13	8	115	1·27	·79	2·265	1·078	·419	1·602	5·364	266,856	1·75	·91
Chesterfield ...	3·56	5·20	6	12	7·15	108	1·38	·75	2·344	·554	·670	1·641	5·209	361,421	1·25	1·31
Colchester	4·159	6·276	10·68	18	6·12	171	1·13	·97	2·492	·873	·794	2·117	6·276	498,758	1·50	1·41
Croydon	4·661	6·673	48	60	6·85	725	2·15	·52	2·798	·777	1·086	2·012	6·673	1,511,590	2·00	1·006
Darlington	3·284	4·723	11	16	6½	151	1·098	·82	2·285	·432	·567	1·439	4·723	429,105	1·25	1·15
Darwen	5·817	8·587	6	17	8·75	108	1·05	·81	3·196	·728	1·893	2·770	8·587	395,096	1·75	1·64
Derby	E. 4·318 H. ...	6·327 10·837	... ...	89 5	... ..	... ...	... ...	... ...	3·16 3·294	·577 ·358	·581 ·741	2·009 6·444	6·327 10·837	1,137,705	1·50	1·34
Doncaster	2·974	4·716	13	25	7·5	222	1·25	·8	1·7	·482	·792	1·742	4·716	575,470	1·50	1·16
Douglas (I.O.M.) ..	4·897	8·029	H 24 Sum. C 9 ,,	43 14	6	...	1·5 1·37	1·23 Sum. 1·45 ,,	2·365	1·033	1·499	3·132	8·029			
Dundee	4·934	7·307	42	60	6·2	528	1·468	·786	2·893	·774	1·267	2·373	7·307	2,207,559	1·25	1·8
East Ham	4·999	6·546	25	40	7	448	1·57	·64	2·915	·687	1·397	1·547	6·546	1,095,511	1·5	1·03
Gloucester	3·87	5·10	15	30	6·78	217	1·50	·62	2·526	·646	·705	1·225	5·102	637,491	1·00	1·21
Halifax	5·751	8·552	57	96	7·2	912	1·30	·77	2·886	1·125	1·740	2·801	8·552	3,033,499	1·50	1·87
Ilford	4·778	6·372	14	22	7·5	221	1·373	·74	3·053	·904	·821	1·594	6·372	897,916	1·146	1·392
Ipswich	4·265	5·916	19	36	6·30	216	1·53	·693	2·805	·635	·825	1·651	5·916	720,246	1·50	1·101
Keighley	3·306	4·854	7	12	7·61	126	2·35	·994	2·359	·513	·434	1·548	4·884	227,137	1·75	·68
Kilmarnock ...	3·193	4·598	9·11	14	7·43	121	1	·97	2·182	·545	·466	1·405	4·598	369,551	1·25	1·12
Kirkcaldy	3·305	4·956	18	22	6½	184	1·50	·64	2·437	·462	·406	1·651	4·956	685,269	1·125	1·467
Lancaster	4·687	6·936	6	12	8	96	1·019	·959	2·793	1·064	·830	2·249	6·936	240,820	1·817	1·238
Leith	3·828	4·985	21	37	7	315	1·56	·63	2·476	·692	·66	1·157	4·985	971,699	1·026	1·13
Lincoln	4·903	6·699	4	8	7	72	1·75	·428	2·513	1·477	·913	1·796	6·699	164,314	1·50	1·197
Liverpool	5·655	7·635	389	494	8	5,446	2·375	·43	2·945	1·079	1·631	1·980	7·635	20,381,934	1·177	1·682
Lowestoft	4·15	6·37	14	19	8	196	univ'rs'l penny fare		2·56	·60	·99	2·22	6·37	356,551	2·14	1·04
Maidstone	3·854	6·160	5	7	6·4	71·66	1	1	2·066	1·002	·786	2·306	6·16	206,932	1·75	1·31
Manchester ...	5·00	7·03	425	566	7·37	6,175	2·12	·56	3·04	·98	·98	2·03	7·03	25,072,791	1·259	1·61
Nelson	3·971	6·457	6	9	10	108	1	1	2·494	·452	1·025	2·486	6·457	252,546	2	1·24
Newport (Mon.) ...	4·779	6·794	26	40	6·67	390	1·62	·61	2·305	·944	1·530	2·015	6·794	1,153,398	1·35	1·49
Nottingham ...	5·14	7·12	77	115	6·50	15	1·62	·65	2·94	1·10	1·10	1·98	7·12	4,316,656	1·25	1·61
Oldham	4·297	7·145	48	80	6·50	864	1·12	·871	2·652	·570	1·075	2·848	7·145	3,453,037	1·50	1·89
Perth...	3·473	5·294	8	12	6·25	120	1·01	1·073	2·619	·708	·146	1·821	5·294	279,694	1·49	1·21
Plymouth	4·999	7·276	28	42	7·25	336	1·75	·75	2·267	·908	1·715	2·386	7·276	938,006	1·75	1·34
Rochdale	4·065	6·028	33	59	7	495	1·14	·95	2·725	·462	·878	1·828	5·893	1,896,278	1·16	1·69
Rotherham ...	4·640	7·318	17	31	8	272	1·6	·62	2·937	·860	·843	2·678	7·318	1,103,804	1·50	1·785
Salford	4·418	6·476	125	177	7·75	2,125	1·50	·59	2·791	·662	·965	2·058	6·476	7,983,603	1·358	1·53
Southampton ...	5·366	7·679	45	51	7	557	1·25	·75	2·947	·944	1·475	2·313	7·679	1,333,050	1·98	1·17
Southport	4·282	6·017	14	26	6·5	210	1·3	·72	2·415	·883	·981	1·735	6·016	504,385	1·50	1·16
South Shields ...	3·37	5·20	15	35	6·89	222	1·50	·62	2·16	·79	·42	1·83	5·20	710,234	1·44	1·27
Stalybridge, etc...	3·840	5·389	41	55	6·75	577	1·24	·8	2·515	·630	·695	1·549	5·389	2,203,128	1·0	1·849
Sunderland ...	4·374	6·379	45	70	7	726	1·44	·68	2·879	·845	·650	2·005	6·379	1,826,167	1·69	1·18
Wallasey	5·082	7·562	29	35	7	435	1·50	·62	3·26	·89	·931	2·48	7·862	1,316,215	1·62	1·52
Walsall	4·760	6·314	17	28	7	255	1·24	·83	2·687	·949	1·123	1·555	6·314	662,582	1·50	1·083
Warrington ...	4·821	6·950	11·386	21	6·46	182·17	1·25	·803	2·790	·815	1·216	2·129	6·950	610,115	1·50	1·42
West Ham	5·314	6·798	80	100	6¾	1,040	1·85	·56	3·723	·738	·853	1·484	6·798	3,797,337	·99	1·48
Wigan	5·62	8·07	48	67	8	960	1	1	2·543	1·33	1·75	2·45	8·07	2,369,000	1·50	1·63
Wolverhampton ...	4·252	6·095	30	43	6½	420	1·125	·867	2·467	·823	·942	1·843	6·095	1,582,325	1·125	1·638
Yarmouth (Gt.) ...	4·12	5·693	22	31	6	324	1	1	2·612	·742	·766	1·573	5·693	539,902	1·75	·897

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

															Works Cost.	
Belfast	3·96	4·68	199	232	8·75	1,931	2·33	·40	2·48	·56	·92	·72	4·68	6,434,835	·59	1·21
Bexley	5·529	7·904	...	16	7·5	...	1·31	·80	2·885	1·174	1·470	2·375	7·904	408,497	1·561	1·52
Birkenhead ...	5·009	6·07	43·55	59	7·128	509	1·38	·64	2·727	·922	1·360	1·061	6·070	2,398,274	·58	1·81
Bournemouth ...	5·29	7·27	57	81	6·61	1,026	1·16	·87	3·07	·84	1·38	1·98	7·27	2,676,833	1·306	1·51
Cardiff	5·311	5·95	87	130	6·50	1,104	2	...	3·374	·858	1·079	·64	5·95	4,842,074	·35	1·84
Glasgow	5·353	5·721	543·98	780	7·91	7,616	2·29	·45	2·890	1·023	1·440	·369	5·721	24,974,056	·301	1·23
Huddersfield ...	4·65	5·32	44·25	70	6·6	708	1·25	·82	2·52	·52	1·61	·67	5·32	3,722,598	·33	2·04
Hull	4·93	5·69	71·25	116	10	1,140	2·75	·36	2·48	·73	1·72	·76	5·69	3,582,831	·63	1·21
Leeds	5·02	5·58	186	270	7·21	2,790	1·95	·54	2·84	·96	1·22	·56	5·58	13,091,475	·32	1·78
Leicester	4·377	4·965	92	140	8	1,472	2·15	·493	3·018	·635	·724	·588	4·965	5,349,665	·358	1·60
London	H 5·622 E 5·704	10·117 6·906	466 420	723 671	6 8·5	6,291 6,300	... ...	... ...	3·506 3·156	1·212 1·308	·904 1·240	4·495 1·202	10·117 6·906	32,782,702	·596	2·02
N'castle-on-Tyne...	5·23	6·04	111	187	7	1,665	1·58	·65	3·15	·93	1·15	·74	5·97	7,659,050	·41	1·80
Northampton ...	3·99	5·00	16·50	22	5·6	264	1·34	·68	2·55	·85	·59	1·01	5·00	878,889	·625	1·62
Portsmouth ...	4·384	4·991	73	100	6	15	1·50	·85	2·891	·835	·658	·607	4·991	2,230,460	·599	1·378
Preston	4·929	5·514	20	30	7·36	360	1	·95	2·671	1·195	1·063	·585	5·514	1,461,304	·362	1·409
Reading	3·88	4·77	25	36	7	400	1·47	·69	2·224	·973	·684	·889	4·770	1,090,416	·75	1·063
Sheffield	5·202	5·940	178·23	263	6·727	2,940	2·50	·38	3·442	·714	1·046	·738	5·940	11,546,500	·391	1·697

C—Cable line. E—Electric trolley system. H—Horse lines. * And general.

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PERSONAL.

Mr. C. A. L. Prussman, borough electrical engineer, Swansea, has been granted two months' leave of absence owing to ill-health.

Mr. A. M. Mulliner has been appointed assistant to the borough electrical engineer of Eccles at a salary of £120 a year. He has hitherto been engineer-in-charge at Southport Corporation electricity works.

Mr. G. W. Keats, acting electrical engineer to Woolwich Borough Council, has been appointed electrical engineer at £325 per annum, rising by £25 a year to £400.

Mr. A. Redfern, chief assistant in Darlington Corporation electricity and tramways department, has been granted an increase of salary to £156, rising to £170 a year hence.

Mr. J. W. Galloway, rolling stock superintendent of Rochdale Corporation tramways, has been appointed to be rolling stock superintendent of Halifax Corporation tramways.

Mr. W. J. Bache, electrical engineer to Cheltenham Corporation, has been granted by the Lighting and Electricity Committee an increase of salary from £400 to £500 per annum.

Lieutenant-Colonel Crompton, C.B., has been elected president of the Institution of Electrical Engineers. He has on a previous occasion held the post, his previous year of office being 1895.

Mr H. J. Mills, outside superintending engineer and assistant contract manager to Johnson and Phillips, Limited, has been appointed electrical engineer for the Franco-British Exhibition.

Mr. C. Fawcett, electrical engineer to Darwen Corporation, has been granted an increase of salary from £250 to £275, with a further increase to £300 from January, 1910.

Mr. Arthur Jacob, M.Inst.E.E., has severed his connection with Siemens Brothers' Dynamo Works, and has undertaken the management of the commercial arrangements of the British Aluminium Company.

Mr. D. E. Bell, of Sunderland Corporation electrical department, has been presented with a gold watch and a cigarette case on leaving to take up a position at Middlesbrough, with the Cleveland and Durham Electric Supply Company.

Mr. H. Talbot, president of the Municipal Electrical Association, has accepted a seat on the committee of the Electrical Exhibition, which will be held in Manchester in October. Mr. Talbot will represent the interests of the Association and of the Nottingham Corporation, who are supporting the Exhibition.

Mr. W. Steadman, late traffic manager of the Kidderminster and Stourport Tramway Company, who has been appointed traffic superintendent at Warwick, was entertained at a smoking concert at Stourport on December 30, by the employees of the tramway company, and also by other residents, and was presented with a purse of gold and a painted photograph of his family.

Silver Wedding.—Mr. F. Bland, of Messrs. Edgar Allen and Company, and Mrs. Bland celebrated their silver wedding on New Year's Eve, when they entertained a large number of their friends at a dinner, whist drive, and concert at the King's Head Hotel, Sheffield.

Mr. Arthur Collinson, who resigned the managership of the Metropolitan District Railway last September, has returned to the North Eastern Railway Company. Previous to his London appointment in April, 1906, he was works manager at York, and he has now been made a district superintendent at Middlesbrough, where he succeeds Mr. C. A. Lambert, who has been appointed to a similar position at Hull.

Mr. C. H. Spencer was on December 31 presented by the carsheds and workshops employees of Halifax Corporation tramways with a set of books on technical subjects, on the occasion of his retirement from the post of rolling stock superintendent. Alderman Hey, who made the presentation, spoke in high terms of the services which Mr. Spencer had rendered, and also of those of his father in the position of general manager. Mr. C. H. Spencer was to be congratulated on the fact that he was getting clear of municipal service altogether, and was going into a business of his own. Mr. Spencer made a suitable reply.

Mr. S. L. Pearce, chief electrical engineer to Manchester Corporation, was, at a meeting of the Council on January 22, reappointed to that post for a period of four years at a salary of £1,100 per annum for the first two and £1,200 per annum for the second two years. Mr. Howarth, the chairman of the electricity Committee, in supporting the proposal, said he thought that the success of the department in the last few years was sufficient justification of the appointment. Although the price charged for electricity had been reduced to 3¾d. per unit, involving a reduction in the annual income of about £20,000 a year, the financial position was now stronger than ever before.

Mr. O. F. Francis.—As a result of the appointment of Mr. Francis, tramway manager and electrical engineer to Kirkcaldy Corporation, to the post of electrical engineer to Carlisle Corporation, a joint meeting of Kirkcaldy Tramway and Finance Committees agreed to recommend to the Corporation that, in order to retain Mr. Francis's services, his salary should be raised by £50, with an increment of £25 for each of the two following years, thus raising it to £400. The recommendation came before the Town Council on January 4, and, after much discussion, it was adopted by 15 votes against 10. As a result of this action by Kirkcaldy, the Carlisle post has now been offered to Mr. Allen, chief assistant engineer at Plymouth. The salary attached to the Carlisle position is £300, rising by £20 annually to £400.

Mr. James D. Caird was on January 3 appointed by Halifax Tramways Committee to the post of traffic superintendent at a salary of £250, rising to £350 a year. For some time he has been traffic superintendent of Aberdeen Corporation Tramways, and he also acted as interim manager in that city during the last illness of Mr. David Moonie, and pending the appointment of a successor to that gentleman. On January 17 Mr. Caird was presented with a silver tea service on the occasion of his leaving Aberdeen for Halifax.

NEW CONTRACTS AND ORDERS.

Walter Scott, Limited, have an order from Portsmouth Corporation for 50 tons of girder rails at £8 5s. per ton.

Willans and Robinson, Limited, have had a tender accepted by Southampton Corporation for a steam generator at £7,851.

East Ham Town Council has accepted the tender of Callender's Cable Company, Limited, for cables at £224.

The Diesel Engine Company have an order for a 500 B.H.P. engine for the power-station of the Calcutta Tramways Company.

The United Electric Car Company have an order from Southport Tramways Committee for two car roof covers at £115.

The British Electric Transformer Company have an order from Croydon Corporation for two 100 KW. transformers at £211.

The Tudor Accumulator Company are the successful tenderers for a storage battery for Llandudno Council at £1,741.

The British Insulated and Helsby Cables, Limited, have received an order from West Bromwich Town Council for a supply of cables.

Dick, Kerr and Company, Limited, have had their tender accepted by Belfast Harbour Commissioners for the construction of tramways at the new harbour.

Rawtenstall Town Council have accepted tenders by Browett, Lindley and Company for steam dynamos, and W. T. Glover and Company for lighting and traction cables.

Mountain and Gibson, Limited, have an order from Leyton Urban Council for car wheels at £3 17s. 6d. each, wheel tyres at £1 17s. 6d., and wheel centres at £2.

Hull Corporation have awarded contracts to the British Insulated and Helsby Cables, Limited, for cables at £254, and to Messrs. J. McMillan and Company, for instruments at £369.

The Lahmeyer Electrical Company have obtained a contract from Leyton Urban District Council for a supply of extension cables at £1,785. The tender was the lowest among eight.

The Bradford Electrical Engineering Company have obtained a contract for an electric power and light installation and switchboard for Harrison's printing works, Bradford.

Stoke-on-Trent Town Council have accepted tenders by the Phœnix Dynamo Company for a balancer and booster at £267 10s., and by the Switchgear Company for switchgear at £98 17s. 6d.

Dick, Kerr and Company, Limited, have had tenders accepted by Portsmouth Corporation for 100 tons of 96 lb. girder rails at £7 10s. per ton, and 100 pairs of fishplates at 5s. per pair.

E. Bennis and Company, Limited, have a contract from the Kensington and Notting Hill Electric Lighting Companies for three chain grate stokers for Shepherd's Bush joint station.

Messrs. J. Gordon and Company, London, have received an order for three "Samson" hydraulic turbines for coupling to alternate-current generators, for a hydro-electric plant at Malakand, India.

Messrs. H. Lotery and Company, 4 to 8, St. Mary Street, London, N.E., have received an order for the supply of uniform clothing to the Exeter city police, and an order from the Rhymney Railway Company. They have also been awarded part of the order for uniforms for the Blackburn police, and for the clothing for the Surrey County Asylum.

The Glacier Anti-Friction Metal Company, Limited, 91, Queen Victoria Street, London, E.C., has been awarded a contract by the London County Council for anti-friction metals for the tramway department for the year 1908.

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The British Westinghouse Company have received an order from the Treforest Electrical Consumers Company for a 3,000 KW. turbo-generator and high-vacuum surface-condensing plant, fitted with Westinghouse-Leblanc dry air pump.

Grimsby Town Council have accepted tenders by Johnston and Phillips for two years' cable supply at £1,358; by the Phœnix Dynamo Company for an engine and dynamo at £2,383; and by Bertram Thomas for a switchboard at £299.

Messrs. Bruce Peebles and Company have received an order from Manchester Corporation for eight Peebles-La Cour motor converters, in sizes ranging from 250 to 600 KW., each machine receiving current at 6,600 volts, and converting to either 415 to 425 for lighting, or 500 to 550 for traction.

Glasgow Tramways Committee have accepted the following tenders: British Thompson-Houston Company, finger arc shields for controllers; British Insulated and Helsby Cables, extra high-tension rubber cables; Siemens Bros., 7/18 and 7/22 lighting cables.

Callender's Cable Company have had a tender accepted by Battersea Borough Council for cables (based on 25 tons of copper at £63 a ton) for one year, the company to maintain the whole of the cables supplied by them for one year further.

London County Council have confirmed contracts as under: Car traverser for central car repair depôt, Appleby's, Limited, £513 10s.; 2,000 track insulators, Buller's, Limited, 3s. 5½d. each; two miles of jumper cable, Callender's Cable Company, £800.

The Continuous Rail Joint Company, Limited, have received a further order from the contractors, Messrs. J. G. White and Company, Limited, for an additional quantity of their patent continuous rail joints for the Nedland extension of the Perth tramways, Western Australia.

Bury Tramways Committee have accepted the following tenders for the year: Uniform clothing, H. Lotery and Company, London; brake blocks, Fred R. Cass, Bury; tickets, J. R. Williams and Company, Liverpool; hire of punches, Bell Punch and Printing Company, Limited, London.

The British Westinghouse Company have had their tender accepted by Cardiff Electricity and Tramways Committee for a 50 KW. transformer at £53 10s., and a 40 KW. transformer at £47. The machines are required for the lighting of the Cardiff stations of the Great Western Railway Company.

Huddersfield Corporation have recently placed an order with the Mirrlees Watson Company, Limited, of Scotland Street, Glasgow, for an elevated counter current jet plant, dealing with 120,000 lb. of steam per hour, 28½in. vacuum with cooling tower water. This is one of the largest contracts of the kind that has lately been placed.

Messrs. Mellowes and Company, of Corporation Street, Sheffield, have recently been favoured with orders for glazing, with their "Eclipse" patent imperishable system, the roofs of works extensions for: Jonas and Colver, Limited, Sheffield; A. Guinness, Son and Company, Limited, Dublin; Tranmere Bay Development Company, Limited, Birkenhead; Aberdeen Salt Fish Company, Limited; and also for the Ashford Station reconstruction, S.E. and C. Railway, and Blackness Library, Dundee.

The Mirrlees Watson Company, Limited, of Scotland Street, Glasgow, have recently received orders for a number of condensing plants, amongst which are the following: John H. Wilson and Company, Birkenhead, surface condensing plant; National Electric Construction Company, for Rhodda Tramways, surface condensing plant; Trafford Power Electric Supply, second repeat order; John Brown and Company, Limited, Sheffield, elevated jet condensing plant; British Thomson-Houston Company, for City Road power-station, third repeat order; and British Thomson-Houston Company, for Rangoon, second repeat order.

Huddersfield Town Council have accepted contracts in connection with the doubling of various sections of single track as under: Rails and fishplates, Bolckow, Vaughan and Company; points and crossings, Hadfield's Steel Foundry Company; bolts and nuts, Ibbotson Bros.; tie bars, Walter Scott, Limited; copper bonds, Lahmeyer lectrical Company. The tender of Messrs. Pearson, Huggins and Company, London, has been accepted for uniform clothing for motormen and conductors, tunics and trousers: Messrs. J. Smith and Company, Derby, and Mr. E. A. Washington for caps; and Messrs. Mackintosh, Manchester, for mackintoshes.

Manchester Tramways Committee have accepted the following tenders:

The Morgan Crucible Co., Ltd.—Two Morgan patent tilting furnaces for making cast-iron-bound crossings.
John Shaw & Sons.—A hydraulic armature press.
F. Smith & Co., Ltd.—10 miles of hard-drawn copper trolley wire.
Smith & Forrest.—1,800 tons of pitch.

The Electricity Committee have given orders as under:

Ferranti, Limited.—High-tension feeder panel at Oldham Road sub-station.
Connolly Bros., Ltd.—Single-conductor cable, and low-tension service cables.
British Insulated and Helsby Cables, Ltd.—Single-conductor low-tension and extra high-tension cables.
Bruce Peebles & Co., Ltd. Motor converters at various sub-stations.

TRAMWAY AND LIGHT RAILWAY NOTES.

ABERDEEN.—It is reported that Aberdeen Corporation have got the price of car roof covers down from £180 to £150. The figure is still higher than that paid in many towns.—New rooms for the Aberdeen Tramway Employees' Social and Athletic Club were opened on January 17. The funds for fitting up the rooms were aided by the proceeds of a concert. The opening ceremony was attended by a large number of the employees, and Mr. J. Taggart, chairman of the Tramways Committee; Mr. R. S. Pilcher, general manager; Mr. J. D Caird, traffic superintendent; and a number of town councillors were also present.

ACCRINGTON.—The Baxenden section of Accrington Corporation tramways, being the last part of the undertaking to be completed, has been inspected and passed by the Board of Trade. The whole work of laying 11¾ miles of tramways was carried out within seven months.

BELFAST.—At a meeting of Belfast Tramways and Electricity Committee, the electrical engineer (Mr. T. W. Bloxam) reported that the period of maximum load had been successfully passed through by the old plant, and that the business during 1907, in spite of the prolonged strike troubles, was highly satisfactory. The estimated units sold during the year for all purposes was 10,732,000, against 9,222,000 in 1906, an increase of 16·3 per cent.—At a meeting of Belfast ratepayers on January 8, a resolution approving the promotion by the Corporation of the bill for the purchase of the Cavehill and Whitewell Tramway at £60,000 was rejected by a majority.

BOLTON.—A meeting of Bolton ratepayers on January 4, by an overwhelming majority, disapproved of proposals in the Parliamentary Bill promoted by the Corporation for the construction of additional tramways. The Corporation subsequently decided not to take a poll of the ratepayers, so that the proposals are dead.

BRISTOL.—The arrangements made by Mr. Charles Challenger, traffic manager of the Bristol Tramways and Carriage Company, for transporting a large part of the enormous crowd of people attending the international Rugby football match between England and Wales at Ashton Gate, Bristol, on Jan. 18, were of a very complete character and proved highly successful. The staff of the tramways are accustomed to work of the kind, though not on such a large scale, because during the winter months they have to deal fortnightly with large crowds attending football matches at the Bristol City ground. The service of cars usual on such occasions was doubled, and the cars ran between Bristol Bridge and Ashton Road, and Tramways Centre and Hotwells. As the football ground was opened at midday, the work of taking the people there was not so arduous, as it was spread over a length of time, but for a considerable period before the match began the interval between the cars was only 50 seconds. At the conclusion of the match all available cars were in waiting, and by the construction of a cross-over near the terminus space was found for 50 cars without interfering with the ordinary tramway traffic. Another lot of cars was in readiness at Hotwells. Before the match there was considerable fog, but not enough to prevent the drivers of the cars from seeing from one passing place to the next on the single track, so that the traffic was smartly carried on, and passengers were transported without delay. At the close of the match, however, the fog was so dense that a view could not be had from one tramway siding to the next, but the difficulty was overcome by the use of Mr. Challenger's code of fog signalling by means of the car gongs. It so happened that a large number of people left the football ground shortly before the close of play, and these were comfortably taken away, and the cars so employed had time to be back for a second journey before the last of the people were away from the grounds. In this way a much larger number was carried than would have otherwise been possible.

DUMBARTONSHIRE.—The work of laying down the tracks on the Dumbartonshire tramways from Dalmuir (where they connect with Glasgow tramways) to Dumbarton, and from Dumbarton to Alexandria and Balloch at the south end of Loch Lomond, is to be commenced during February. The contractors are Messrs. J. G. White and Company, and the cost will be about £144,000. This is apart from the already constructed Dumbarton burgh tramways, which cost £40,000, and will form part of the scheme. The Dumbarton Burgh and County Tramways Company has a capital of £155,000, and the managing director is Mr. George Balfour. Current will be obtained from the power-station in Dumbarton of the Electric Supply Corporation, and the car shed accommodation in the burgh will be increased.

DUNDEE.—Dundee Tramways Committee on January 13 resolved that six new cars now on order should be fitted with air brakes at a cost of £55 each. In connection with the erection of a new generating station for Dundee, the contractors for the foundations have commenced operations, and the work is being pushed forward.

ERITH.—At a meeting of electors of Erith held on January 7, a resolution to approve of the Tramways Bill proposed to be promoted by the Urban District Council, was rejected by a large majority. This bill has since been dropped.

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GLASGOW.—Over 400 cases of boys hanging on to tramway cars have been dealt with recently in Glasgow. Plain-clothes inspectors have been employed for the purpose of catching the boys in the act. To discourage the youngsters from risking their lives, they have in most cases been fined at the police-courts in sums from 1s. upwards.

GLOUCESTER.—In moving adoption of minutes of the Light Railways Committee at a meeting of Gloncester Town Council on January 1, Mr. Ford said that since the last meeting of the Council they had in operation, in addition to the halfpenny fares, the route and service alterations which had been approved. They had instituted a five minutes' service from the Cross to the Avenue, and also a similar service from the Cross to Barton Gates. He considered the result, so far, very satisfactory. For three weeks and three days ending on Christmas Day during which those alterations were in force they had an increase of revenue, as compared with the corresponding period of last year of £22 1s. 8d., and they had carried 37,222 more passengers. They had run 417 fewer miles, consumed 482 fewer units of electricity, and the wage sheet for the whole staff showed a reduction of £3 3s. 6d. for the three weeks. Since they re-started halfpenny fares they had in seven weeks carried 73,223 more passengers than in the corresponding period of last year. The public had had the convenience of cheap rides, and the undertaking had not lost thereby, but gained. They had heard it said that their light railways would never pay, but he was not prejudiced enough to believe that. He had every faith in the ultimate financial success of the undertaking.

HALIFAX.—Halifax Tramways Committee have approved a suggested scheme for the formation of a mutual tramway accident insurance fund. The proposal is to form a mutual organisation, composed of municipal and company tramway owners, each one contributing to the funds on the basis of the present premiums. It is suggested that even if only 25 tramway undertakings were to join out of the existing large number, the premiums would reach £40,000 per annum as a minimum, and this sum, it is said, should be sufficient to cover all liabilities. The suggested amalgamation of the premiums of the tramway owners would lead to the establishment of a committee of experts on tramway matters, and this committee would be able to appraise each risk at its true value, and very little reserve, if any, would be required. If there is any serious accident, or series of accidents, calling for more compensation than the total premiums, the amount required would be contributed pro rata. The Committee resolved to ask the Town Council to convene a conference of representatives of corporations and tramway companies to consider the proposal.

HULL.—Hull Tramways Committee have resolved that the hours of work of car washers and depot men be reduced from 60 to 56 per week, that these men be paid 6d. per hour, that the chargemen at the five depots be paid 1s. per week extra, and that the wages of conductors over 21 years of age be increased to 6d. per hour.—The tramway clauses of the bill which Hull Corporation are promoting in Parliament were rejected by a meeting of ratepayers on January 8.

LEEDS.—A meeting of Leeds Tramways Committee was held on January 13 for the purpose of considering an application of the motormen and conductors for (1) a reduction of working hours from 60 to 54 per week, without any change in the rates of wages: (2) for limiting the time in which each duty is performed to 12 hours; and (3) for shortening the periods in which wages are advanced. Returns as to the practice in large cities and towns in the kingdom were presented by the general manager (Mr. J. B. Hamilton). From these it appeared that in five out of 11 towns the official number of hours worked was 60 per week, while in the six remaining centres the hours varied from 54 to 56 per week. In the matter of wages, with the exception of Sheffield the rate of wages in Leeds was higher than that in any other city, being from 36s. 8d. to 39s. 2d. per week for drivers, and 29s. 2d. to 34s. 2d. for conductors. The average for the other towns was 30s. 10d. to 35s. 1d. and 27s. 1d. to 31s. 1d. respectively. The committee decided that they could not accede to the application under any one of the three headings named. They, however, resolved, on the recommendation of the general manager, that all men in uniform with a satisfactory service of seven years and upwards should be granted a merit stripe to be worn on the sleeve of the uniform, and carrying with it an additional 1s. per week in wages.

LEITH.—Mr. John Wilson, general manager of Leith Corporation tramways, has presented a report to the Tramways Committee on the comparative cost of lighting the cars with 8 candle-power and 16 candle-power lamps. In this he stated that he had carried out a comparative test over a period of 900 hours. As a result he found that the cost of maintaining 37 cars with 16 candle-power lamps at the rate of 18 lamps per car, would be £21 15s. 8d., and the current consumed—1,035 units at 1d. per unit—would amount to £159 11s. 3d., a total cost of £181 6s. 11d. The cost of maintaining 37 cars with 8 candle-power lamps at the rate of 30 lamps per car would be £37, and the current consumed—517 units—would amount to £79 15s. 7d., a total cost of £116 15s. 7d. This showed that although the cost of the upkeep of the 8 candle-power lamps was slightly more than that of the 16 candle-power lamps, the current consumption of the former was about half that of the latter. Consequently, with the introduction of 8 candle-power lamps into the cars, a considerable saving in the cost of lighting would be effected—namely, £64 11s. 4d. The report was approved by the Committee, the conversion to 8 candle-power lamps to be brought about gradually.

LONDON.—At Clerkenwell Police Court on December 31—before Mr. d'Eyncourt—Leonard Chalfin was summoned by the London County Council on a charge of failing to produce a tramcar ticket while he was a passenger and of refusing to pay again. In the evidence the conductor of the car admitted that the defendant had paid his fare, but had lost his ticket and declined to pay again. Mr. d'Eyncourt said that the tramway by-law under which the case was brought was no doubt a reasonable one, but it should be reasonably applied, and it was absurd to summon a man under the circumstances of the present case. It was requiring a man to pay twice over. He imposed a fine of 2d., without costs.

MAIDSTONE.—The Tovil extension of Maidstone Corporation tramways was inspected by Major Pringle, of the Board of Trade, on January 9, and in the afternoon of the same day the line was opened for public traffic. On January 17 the Tramways Committee inspected a new workshop for car repairs, and an extension of the car shed. The latter can now hold 20 cars.

MANCHESTER.—At a meeting of Manchester Tramways Committee on January 14, it was stated that the result of the work of the parcel department during a period of nine months had been that an income of £3,670 had been earned, and the expenditure had amounted to £2,586, leaving a profit of £1,084.—The chairman, Alderman Bowes, stated that it was estimated that the recent concession in regard to workmen's tickets on the early morning cars was costing the department £5,000 a year. The experiment as to long distance fares had been more satisfactory. A few months ago the committee, anxious to do something for the 2d. and 3d. passengers, who pay 30 per cent. more per car mile than the 1d. passengers, decided, as an experiment, to reduce the fares on the Middleton route. The results have proved very gratifying, the receipts per car mile having increased from 10·4d. in the corresponding period of last year to 10·57d. As the receipts per passenger have fallen from 1·25d. to 1·21d., this shows that the reduced long distance fares has led to a large increase in the number of passengers. The committee have instructed a sub committee to consider the whole question of long-distance fares.

MORECAMBE.—At a rowdy meeting of Morecambe ratepayers on January 8, a resolution to approve of the bill which is being promoted by the Corporation for the purchase of the tramway undertaking within the borough was rejected by a large majority.

NORWICH.—The Norwich Tramways Company have inaugurated a scheme of what are called return-transfer penny tickets. Hitherto a hardship has been felt by some passengers from the fact that if their journey necessitates a change of car the fare is twopence, though the total distance is no greater than that which can be traversed for a penny on one car. The penny transfer ticket enables the passenger to proceed for half a stage on one car, and then change for another half-stage into another car going on the same or a different route. The ticket may instead be used as a return ticket over the same half-stage of one route. A three months' trial is to be given to the scheme.

ROCHDALE.—The annual dinner of one half of the Rochdale Corporation tramway employees was held on January 9, and was very successful, while under similar favourable auspices the other half of the men dined together on January 16. At the first gathering, Mr. J. S. D. Moffet, the general manager, presided, and others present included Councillor Dunning, chairman of the Tramways Committee Mr. G. Webster, traffic superintendent; and Mr. J. W. Galloway, car-shed and rolling stock superintendent. In the course of the evening Mr. Dunning proposed the health of the employees of the tramway department, and spoke highly of the services and qualifications of the men. He also expressed regret that Mr. Galloway was leaving the service. Mr. Moffet, who replied, said that 90 per cent. of the men had no reports at all against them. The whole staff were sorry to lose Mr. Galloway, and they all hoped he would be successful in his new sphere of labour. Mr. Galloway acknowledged the compliments paid to him, and said it had always been his endeavour to keep the rolling stock in as efficient a state as possible.

SOUTH SHIELDS.—Some sensation was caused at a recent meeting of South Shields Town Council by a statement that the cars were not safe for public use. A sub-committee have since investigated the matter, and have found that the wheel flanges of some of the cars had suffered wear. The sub-committee gave orders for the necessary renewals, and came to the conclusion that there was no ground for alarm.—At a meeting of the Town Council on January 28, a long discussion took place on the following motion: "That in view of the serious difficulties which have arisen from time to time between the manager and the car-shed superintendent, and the apparent impossibility of their being able to work together to the advantage and satisfaction of the committee and the undertaking, and to the fact that the machinery and the cars have not been maintained in such a condition of order and repair as might have been, this Committee deem it advisable to request the car-shed superintendent to hand in his resignation." The resolution was carried by a large

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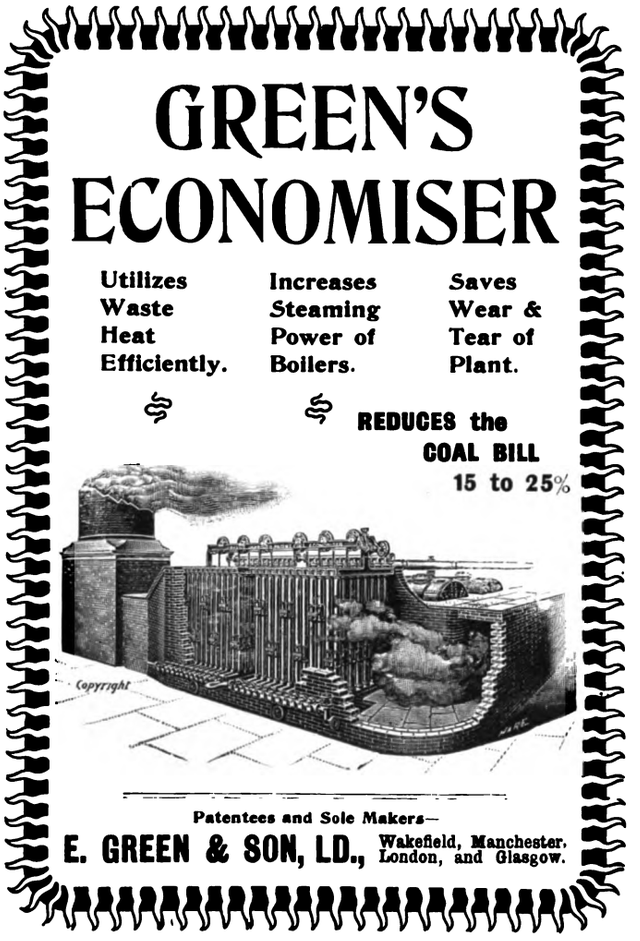
majority.—A most unusual case was investigated by the South Shields coroner on January 14. Thomas Twigg, 31 years of age, was the driver of one of the Corporation's electric cars, and he appeared to be in robust health. He was in charge of a car on January 11, and he was chatting with the conductor and laughing a few minutes before a stoppage was made. When the conductor rang the bell as a signal for resuming the journey there was no response, and on going forward the conductor found the driver leaning over the side rail. He appeared to die immediately. A medical man who saw the body soon afterwards said that, despite the man's healthy appearance, there was no doubt that he suffered from heart disease. His death had been accelerated by exposure to the cold. It was stated there was no glass screen to protect drivers, and the vice-chairman of the Tramways Committee said this should have due attention.

WALSALL.—At a meeting of Walsall Town Council on January 13, Alderman J. Cope, chairman of the Tramways Committee, in presenting a report, drew attention to a saving of over £6,000 which had been effected, compared with the estimates, in connection with recent reconstruction of the tramways. He said the result fully justified the action of the Council in deciding to carry out this work with their own staff, instead of putting it out to contract. He claimed that, while economy had been exercised, the work had been well and efficiently done, and for this a good deal of credit was due to the officials concerned. He considered the result was an argument in favour of the Corporation in future carrying out all similar work. Mr. Halford supported the views expressed by Alderman Cope, and urged that the officials who had effected this saving were entitled to something beyond a vote of thanks.

WEST HAM.—On January 7 the Committee of the West Ham Tramways Social and Athletic Club gave a New Year party to the children of the tramway employees. The gathering took place in the recreation-room of the Greengate depôt, which was gaily decorated. The chief attraction was a huge illuminated Christmas tree laden with presents for every one of the children. 225 children sat down to tea, and they were each presented with a new penny by Master Eric Blain, son of the tramways manager, Mr. H. E. Blain. Subsequently there was a musical entertainment, and this was followed by the distribution of the gifts from the Christmas tree. Motorman C. A. Gainsbury, dressed up as "Father Christmas" made the presentations. Later in the evening a dance for adults was given. The committee of the club obtained valuable help in organising the entertainment from local ladies and gentlemen, and the whole proceedings were most successful.



PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

∴ If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS.

Applications for Letters Patent have been filed :

1907.

28,222 Electric trolley pole and wheel guide for electric tramcars—W. Wye.
28,281 Collapsible trolley pole for electric vehicles—G. S. Thomson.
28,426 Insulators for overhead systems of electric railways—British Thomson-Houston Company, Limited (*General Electric Company*,
28,435 Electric signalling for railways—A. Gardiner.
28,436 Electric signalling for railways—A. Gardiner.
28,447 Means for preventing accidents on electric railways—J. V. Dickins.
28,449 Slipper brakes—H. Mattinson.
28,472 Emergency brake for electric tramcars—G. Bingham.
28,483 Rapid excitation for the dynamos of petrol electric automobiles—W. A. Stevens.
28,488 Bolts for tramcars, railway carriages, and motor cars—R. Harvey.
28,494 Jointing system for preventing the falling of ærial wires of electric tramways—A. G. Boon and F. Mellaerts.
28,507 Electrical overload indicators—H. T. Harrison.
28,546 Brakes—E. Freund.
28,595 Brake applicable to tramcars and other road vehicles—J. Mitchell.
28,634 Electric locomotives—B. G. Lamme and N. W. Storer.
28,658 System of feeding current in electric railways—L. de Matteis.
28,679 Removing, detaching, or uncoupling railway and tramway vehicles from one line of rails to another.—H. Sulley.

1908.

33 Braking apparatus for tramway vehicles—J. Maunder, H. Thompson, and J. B. Mitchell.
135 Non-skid device for the wheels of motor omnibuses—A. C. Beech.
153 Trolley poles—J. Shepherd and F. B. Ullery.
170 Kerb for tram rails—S. H. Adams.
174 Automatic control of engines, trains, or trams, both steam and electric—W. F. Bladon.
257 Track rail-grinding apparatus—J. A. Kidd and A. Ellis.
368 Reversible out-side seat for tramcars and omnibuses—J. Anderson and C. P. Kelsall.
498 Points setting of a railway or tramway by the driver of an approaching car—D. D. Samaia.
577 Electric driven vehicles—P. Kopp.
584 Means for preventing or reducing the raising of dust by motor cars and tramcars—J. B. Peace and R. Lamb.
784 Trolley pole contacts—E. Sheldon.
786 Life-saving device or guard for tramcars—W. Timbrell and C. E. P. Gabriel.
790 Brakes for mechanically-propelled vehicles—F. J. A. Paton.
922 Rollers of route or destination indicators, and blinds for railway carriages and tramcars—B. Andrews.
1,036 Railways and tramways and rolling stock—C. H. Collings.
1,109 Tramway rails—W. F. Chambers.
1,178 Frictional blocks for brake blocks and electrical collector slippers—C. C. W. Simpson.
1,187 Electric conductors and collectors for electric railways and tramways—R. C. Thomson.
1,188 Devices for operating points of tramways—A. A. M. Taveira.
1,221 Trolleys or collectors for electric railways and tramways—H. J. Tompkins.
1,239 Suspending device for electric conductors—R. L. Hoffman.
1,240 Suspension devices for electric conductors—F. Guillot.
1,297 Mechanism for railway points—H. A. Thomson.
1,326 Railway rail joints—B. Wolhaupter.
1,360 Railway crossing—A. Hosmer and J. D. Collett.
1,428 Slipper brake gear for tramcars—T. Voss.
1,478 Steel rails—W. Lees.
1,517 Apparatus for the protection of railway or tramway vehicles in case of failure of the driver—Siemens Brothers, Dynamo Works, Limited, and F. Lydall.
1,556 Axle boxes, bearings, flanges, and guides—W. A. E. Crombie.
1,629 Tramway rails—W. F. Chambers.
1,650 Tramway brakes—R. H. Wilkinson.
1,723 Tramway track brakes—G. Moorhouse
1,751 Vehicles propelled by a combination of electrical and mechanical power—W. N. Stewart, E. B. Killen, and F. Harris.

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Specifications Published.

1906.

27,932A Railway and tramway axle-boxes—Demolder.
28,306 Brakes for rolling stock of railways and tramways—Maley.
26,066 Trucks for electrically-propelled vehicles—British Thomson-Houston Company (*General Electric Company.*)
28,339 Means for applying braking power to tramcars—Lockett.
29,072 Electrically-operated railway signals—Brown.
26,623 Emergency brake for motor omnibuses—Whittaker.
29,618 Sectional poles for telephone, telegraph, and trolley wires—Sciple.
27,731 Tramcars—Anger.

1907.

7,388 Underframe for passenger cars—Christianson and Standard Steel Car Company.
7,720 Rail joints—Bridges.
22,618 Joints for railway and tramway rails—Whittaker and Whitmore.
7,200 Appliances for operating railway and tramway points—Peacock.
7,389 Roof construction for passenger cars—Christianson and Standard Steel Car Company.
18,463 Combined cross-ties and rail fastenings—Ford and Wassam.
18,498 Electric locomotives—Böhm.
18,793 Double wire overhead electric trolley systems—V. Kando.
20,103 Railway rail chairs—Marshall and Penman.
61 Car fenders—Wheelock.
1,806 Paving blocks for the side of tramway rails—Morland-Johnson.
7,800 Conduits for electric cables—Goodman and Ackland,
15,769 Electrical railway systems—Beecher.
18,592 Bogies for railway vehicles—Sheffield and Twinberrow.
19,137 Railway rail joints—Carroway and Crews.
836 Portable tram rail grinding machines—Smith-Saville.
7,393 Body construction of passenger cars—Christianson and Standard Steel Car Company.
8,623 Propulsion of electrically-driven trains—Stone and Migotti.
23,983 Insulating and post for railway rail joints—Karns.
4,512 Railway and tramway vehicles—Gresley.
5,540 Railway fish-plates—Estal.

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TRAFFIC RETURNS.

TRAMWAYS AND OMNIBUSES.	1906-7. WEEKS ENDING.					1907-8. WEEKS ENDING.					AGGREGATE.		
	Dec. 22.	Dec. 29.	Jan. 5.	Jan. 12.	Jan. 19.	Dec. 21.	Dec. 28.	Jan. 4.	Jan. 11.	Jan. 18.	Wks.	1907-8.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	1.125	1.227	1.456	1.282	1.181	1.182	1.281	1.497	1.356	1.120	33	46.935	– 1,324
Ayr Corporation	171	170	219	168	165	190	182	222	169	172	36	11.287	– 87
Bath Electric	664	873	630	652	653	591	799	637	547	542	2	1.089	– 193
Belfast City	3.527	3.748	3.044	3.223	3.161	3.712	4.218	3.235	3.302	3.361	42	153.946	+ 9,884
Birmingham Corporation	...	...	...	...	5.221	6.834	6.965	6.079	6.057	6.290	3	16.010	+ 1.475
Blackburn Corporation	858	1.192	1.013	837	933	985	1.216	1.103	881	896	42½	47.064	+ 3,103
Blackpool and Fleetwood	188	180	209	175	179	196	260	274	179	167	3	504	– 11
Blackpool Corporation	297	342	342	341	310	297	393	352	339	285	41	48.623	– 1,252
Bolton Corporation	2.013	1.877	2.538	1.985	1.921	2.137	2.152	2.689	1.990	2.056	42	95.717	+ 5,924
Bournemouth Corporation ...	1.241	1.442	1.316	1.330	1.297	1.304	1.538	1.458	1.279	1.256	41½	71.499	+ 1,552
Bradford Corporation	4.263	4.491	4.109	4.061	4.014	4.610	4.924	4.155	4.075	4.175	42	194.778	+ 4,478
Brighton Corporation	754	740	757	738	694	736	805	654	648	663	42	38.422	– 3,224
Bristol	5.036	5.432	4.630	4.754	4.695	4.989	5.790	4.538	4.503	4.561	3	13.602	– 477
British Elec. Trac. Co's. Undertakings													
Airdrie	213	212	278	195	204	225	216	327	203	209	2	557	+ 46
Barnsley	143	191	151	140	149	167	221	168	142	157	2	364	+ 22
Barrow	207	216	213	197	196	226	262	205	203	201	2	485	+ 5
Birmingham and Mid. Joint Com.:													
Birmingham and Midland ...	...	...	...	717	716	820	977	755	737	774	2	1.797	+ 90
City of Birmingham	...	...	...	2.327	2.835	2.854	3.122	3.015	2.244	2.688	2	5.774	– 318
Dudley-Stourbridge	772	838	699	750	762	777	896	690	659	694	2	1.603	– 198
South Staffordshire	774	860	700	798	834	873	1.050	780	765	866	2	1.909	+ 5
Wolverhampton District ...	414	425	376	392	425	437	574	415	386	416	2	944	– 53
Cavehill	47	76	36	47	47	57	91	50	49	57	2	126	+ 16
Devonport	462	451	433	446	436	471	519	422	418	434	2	1.042	– 46
Gateshead	976	1.059	947	887	929	1.014	1.215	1.070	925	951	2	2.325	+ 119
Gravesend and Northfleet ...	211	228	176	208	201	214	293	186	182	182	2	434	– 51
Greenock-Port Glasgow	562	564	610	486	536	511	530	571	391	432	2	1.070	– 222
Hartlepool	228	244	239	220	218	243	296	254	224	217	2	551	+ 14
Jarrow	80	120	106	82	93	104	128	125	92	95	2	236	+ 25

(*Continued on page 132*).

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TRAFFIC RETURNS—*continued.*

TRAMWAYS AND OMNIBUSES.	1906-7. WEEKS ENDING.					1907-8. WEEKS ENDING.					AGGREGATE.		
	Dec. 22.	Dec. 29.	Jan. 5.	Jan. 12.	Jan. 19.	Dec. 21.	Dec. 28.	Jan. 4.	Jan. 11.	Jan. 18.	Wks.	1907-8.	Increase or Decrease.
British Elec. Trac. Cos.—*continued.*	£	£	£	£	£	£	£	£	£	£		£	£
Kidderminster	93	123	83	86	83	96	133	102	74	83	2	187	- 15
Leamington	132	120	152	132	125	132	147	122	115	123	2	290	- 27
Merthyr...	187	286	178	185	185	214	309	197	180	188	2	439	+ 3
Metropolitan Electric	3.173	3.913	3.264	3.763	3.804	4.795	6.152	4.469	4.454	4.463	2	10.743	+ 1.483
Middleton	262	260	237	277	284	314	353	308	265	287	2	683	+ 25
Oldham-Ashton	520	587	198	545	542	543	637	221	516	548	2	1.290	+ 7
Peterborough	100	127	94	95	94	110	172	112	99	99	2	234	+ 10
Potteries	1.835	1.864	1.856	1.744	1.826	2.157	2.235	1.669	1.748	1.833	2	4.246	- 10
Rothesay	41	44	83	44	38	37	44	83	48	37	2	127	+ 10
Sheerness	47	55	48	50	46	53	57	45	53	46	2	107	+ 3
South Metropolitan	612	549	517	703	695	702	944	608	628	639	2	1.511	- 148
Southport	209	163	165	197	192	193	208	191	176	173	2	436	- 45
Swansea...	782	1.001	739	798	794	859	1.133	771	765	793	2	1.868	- 12
Taunton	39	56	40	35	35	42	57	42	36	34	2	85	- 1
Tynemouth	142	156	154	140	149	140	176	173	138	142	2	358	+ 5
Weston-super-Mare	25	25	27	22	25	28	26	29	21	23	2	48	- 2
Worcester	245	269	234	240	225	245	290	231	221	224	2	536	- 32
Wrexham and District	92	118	97	89	87	90	137	89	81	81	2	190	- 20
Yorks. (Woollen) District ...	793	1.049	819	876	899	834	1.159	834	776	856	2	1.960	- 140
Burnley Corporation	1.128	1.264	1.205	1.184	1.141	1.212	1.426	1.227	1.156	1.169	3	3.552	+ 22
Burton-on-Trent Corporation ...	300	274	274	262	245	274	268	238	243	235	42	11.940	- 614
Bury Corporation...	863	830	948	891	894	995	1.096	1.235	971	996	42	46.908	+ 5.721
Cardiff Corporation	1.997	1.957	2.001	1.918	1.869	2.099	2.144	1.840	1.894	...	—	—	—
Carlisle, City of	158	168	173	146	132	170	193	155	144	142	3	442	- 10
Chatham and District	621	660	325	955	656	650	601	426	759	590	2	1.349	- 262
Chesterfield Corporation	253	199	203	185	178	263	221	198	186	211	43	9.573	+ 513
Colne and Trawden	176	180	163	174	185	191	224	164	171	175	—	—	-
Cork Electric	445	453	214	600	419	432	500	274	479	379	2	857	- 161
Croydon Corporation	1.323	1.203	1.172	1.290	1.261	1.371	1.545	1.144	1.147	1.200	42	54.904	- 1.749
Darlington Corporation	203	198	198	182	183	214	217	196	188	181	42	8.918	+ 28
Derby Corporation	780	737	706	698	660	831	903	708	705	714	42	32.658	- 1.752
Dover Corporation	191	169	193	175	176	177	181	158	161	155	42	9.531	- 1.194
Dublin and Lucan	97	120	55	88	92	95	129	38	86	86	3	210	- 25
Dublin United	5.040	4.822	1.079	5.008	4.726	5.190	5.414	2.045	4.753	4.719	3	11.518	- 270
Dundee City	992	1.066	1.298	1.083	1.012	1.078	1.232	1.336	1.316	1.034	35	40.557	+ 1.589
East Ham Corporation	801	834	811	828	799	882	948	893	824	812	42	38.251	+ 392
Edinburgh and District	4.599	4.375	...	...	...	4.696	4.918	...	...	...	—	—	—
Exeter Corporation	265	302	259	256	250	259	304	215	218	236	42	12.995	+ 467
Falkirk and District	...	...	...	...	...	290	340	289	236	248	—	—	—
Glasgow Corporation	16.557	16.108	18.977	16.054	16.230	17.286	17.145	18.991	16.013	16.337	33	681.027	+116.123
Glossop (Urban Elec. Supply Co.) ...	128	122	125	128	129	124	133	107	115	118	3	340	- 24
Hastings and District	...	...	...	...	656	991	745	666	691	725	—	—	-
Huddersfield Corporation	1.422	1.368	1.430	1.410	1.364	1.544	1.566	1.399	1.440	1.433	42	66.582	+ 3.057
Hull Corporation	2.442	2.567	2.387	2.311	2.305	2.603	2.775	2.510	2.466	2.446	42	104.118	+ 5.886
Ilford Corporation	421	413	410	423	402	426	496	374	362	366	42	19.349	- 785
Ilkeston Corporation	100	111	113	114	110	129	125	114	114	119	43	6.090	+ 380
Ipswich Corporation	342	274	326	318	326	336	372	304	288	300	42	16.921	- 1.086
Isle of Thanet	228	182	214	238	243	245	273	198	172	207	3	579	- 117
Keighley Corporation	129	171	135	135	...	150	172	135	130	...	28	4.531	+ 263
Kilmarnock Corporation	141	152	240	139	143	150	140	224	132	138	35	5.641	- 140
Lanarkshire	804	839	541	1.523	823	1.229	1.201	912	2.044	1.096	2	3.139	+ 792
Lancashire United	909	1.043	728	974	1.032	1.105	1.299	1.265	1.037	1.016	2	2.364	+ 73
Leeds City	5.927	6.321	5.847	5.895	5.788	6.472	7.034	6.022	5.899	6.022	42	274.710	+ 11.534
Leicester Corporation	2.144	2.260	2.157	2.015	1.953	2.200	2.413	2.090	1.986	1.995	—	—	—
Leith Corporation...	463	452	579	470	458	474	489	607	476	462	35½	18.734	+ 136
Leyton U. D. Council	800	898	816	868	830	929	1.084	821	790	812	42	43.321	—
Liverpool Corporation	11.405	10.477	10.804	10.728	10.577	11.394	11.151	10.124	10.012	10.011	3	26.247	- 1.719
London County Council	27.256	23.540	25.474	26.988	26.567	32.017	31.615	29.016	28.855	29.637	42	1.312.674	+213.725
London General Omnibus... ...	20.557	14.487	18.481	19.807	18.951	20.390	16.621	16.587	17.380	17.664	3	51.631	- 5.608
London Road Car	6.918	4.931	6.241	6.755	6.742	8.512	6.908	5.093	3.416	5.659	3	11.495	- 5.855
London United	5.220	5.414	5.035	5.371	5.030	5.579	6.695	4.966	4.845	5.043	3	12.776	- 1.510
Lowestoft Corporation	166	110	144	150	139	163	174	153	144	141	18	2.694	+ 102
Maidstone Corporation	...	...	...	...	...	150	213	133	133	150	42	5.651	-
Manchester Corporation	13.899	12.424	13.288	13.175	13.469	14.780	14.577	13.671	13.120	13.725	42	620.763	+ 41.295
Nelson Corporation	126	143	129	132	134	137	153	112	121	127	42½	6.092	- 45
Newcastle-on-Tyne Corporation ...	4.132	3.803	3.991	3.758	3.794	4.175	4.301	4.077	3.746	3.805	42	172.140	+ 1.215
Newport (Mon.) Corporation ...	592	661	570	545	541	634	705	562	560	561	42	28.707	+ 2.054
Northampton Corporation... ...	376	452	377	360	360	376	496	391	361	371	40½	18.162	- 340
Oldham Corporation	1.706	1.386	1.648	1.714	1.695	1.858	1.962	1.701	1.698	1.795	43	83.102	+ 5.693
Portsmouth Corporation	1.572	1.316	1.578	1.582	1.416	1.661	1.488	1.487	1.487	1.471	42	82.718	- 1.371
Preston Corporation	657	845	637	678	660	666	826	734	627	620	—	—	—
Provincial...	1.537	1.476	1.472	1.498	1.386	1.597	1.685	1.453	1.412	1.442	16	23.713	+ 885
Reading Corporation	587	680	581	582	545	599	758	552	547	518	41½	25.999	- 757
Rochdale Corporation	906	888	882	899	...	1.017	1.126	953	884	...	—	—	-
Rossendale Valley...	184	209	176	187	185	185	220	170	158	164	3	492	- 56
Rotherham Corporation	474	624	494	470	498	580	758	636	521	541	41½	25.408	+ 4.126
Salford Corporation	4.663	3.510	4.166	4.189	4.366	4.538	4.459	4.628	4.077	4.241	42	191.442	+ 5.906
Sheffield Corporation	5.412	5.648	5.349	5.256	5.187	5.670	6.284	5.491	5.223	5.428	43	240.097	+ 10.963
Southampton Corporation... ...	876	856	840	845	812	935	1.052	931	899	858	41½	43.007	+ 2.120
Southend-on-Sea Corporation ...	240	243	223	245	255	262	301	258	230	234	42	17.024	+ 63
South Shields Corporation ...	471	515	518	452	448	518	600	559	506	470	42	24.068	+ 5.132
Sunderland Corporation	1.324	1.346	1.384	1.239	1.223	1.271	1.336	1.297	1.129	1.076	42	57.724	- 1.525
Swindon Corporation	150	173	150	146	150	147	189	144	130	129	—	—	—
Tyneside Tramways and Tramroads	365	426	109	342	354	364	443	75	345	336	3	758	- 48
Wallasey U. D. Council	788	718	764	742	722	782	763	719	706	689	42	35.244	+ 613
Walsall Corporation	526	574	349	486	471	564	663	270	483	490	3	1.243	- 65
Walthamstow Corporation... ...	423	433	409	431	430	509	649	448	452	460	42	25.449	+ 1.106
Warrington Corporation	361	390	363	353	351	376	437	366	348	349	42	15.947	+ 582
West Ham Corporation	2.179	2.305	1.992	2.228	2.237	2.269	2.706	2.095	2.089	2.110	42	97.193	+ 1.982
Wigan Corporation	1.102	1.000	1.022	1.079	1.095	1.244	1.403	1.329	1.112	1.134	42	52.952	+ 3.707
Wolverhampton Corporation ...	770	663	787	823	721	867	933	737	748	730	42	39.213	+ 421
Yorkshire (West Riding)	973	1.212	982	1.017	943	1.095	1.436	1.019	1.002	1.032	3	3.053	+ 111
FOREIGN TRAMWAYS.													
Anglo-Argentine...	17.379	20.633	17.887	16.914	16.378	18.360	21.917	18.778	17.624	17.469	3	53.871	+ 2.692
Calcutta ... ... Rs.	53.314	77.153	70.796	61.532	59.816	48.890	51.128	54.460	50.096	48.740	3	153.296	- 38.848
Havana ... ... $	...	30.290	34.211	33.019	...	...	36.191	37.484	34.137	...	—	—	—
Kalgoorlie ... ...(month)	...	4.457	...	...	...	..	4.109	...	...	...	52	47.824	- 3.294
Lisbon ... ... (month) Ms.	...	...	...	...	...	...	...	...	...	...	—	—	—
Madras ... ... Rs.	(2 weeks)	17.783	(2 weeks)	17.255	...	(2 weeks)	20.285	(2 weeks)	19.685	...	2	19.685	- 2.430
Perth (W.A.)	1.724	2.124	1.943	1.726	1.665	1.509	1.910	1.745	1.528	1.523	3	3.792	- 466
Rio de Janerio ... ...(month)	...	513.600	...	...	...	...	563.101	...	...	...	52	6.241.486	—
Singapore ... ... $	8.566	8.134	9.241	9.212	8.844	8.474	8.824	8.927	9.389	9.392	—		-
ELECTRIC RAILWAYS.													
Baker Street and Waterloo ...	2.300	2.195	2.440	2.290	2.296	3.105	2.865	3.230	3.280	3.000	3	9.510	- 2.484
Central London	6.884	5.005	6.401	6.456	6.417	6.477	4.781	6.194	6.318	6.214	3	18.726	- 548
Charing X Euston & Hampstead ...	...	...	...	...	...	3.040	3.080	3.170	3.190	3.190	3	9.550	-
City and South London	3.188	3.214	3.286	2.998	3.011	3.329	3.548	3.631	3.560	3.390	3	10.581	+ 1.286
Great Northern and City	1.942	1.725	1.897	1.965	1.939	1.901	1.672	1.852	1.840	1.876	3	5.568	- 233
Gt. North'rn, Piccadilly, & Brompton	3.180	3.155	3.455	3.535	3.574	5.330	4.960	5.390	5.445	5.390	3	16.225	+ 5.661
Liverpool Overhead	1.455	1.119	1.434	1.412	1.389	1.416	1.191	1.345	1.326	1.402	3	4.073	- 162
Mersey	2.009	1.705	1.845	1.832	1.838	2.077	2.040	2.045	1.921	1.892	3	5.858	+ 343
Metropolitan	16.190	15.801	15.819	15.682	16.030	16.450	16.227	15.974	15.593	15.815	3	47.382	- 149
Metropolitan District	8.211	7.283	8.035	7.995	8.002	8.924	8.128	8.771	8.873	8.919	3	26.563	+ 2.531

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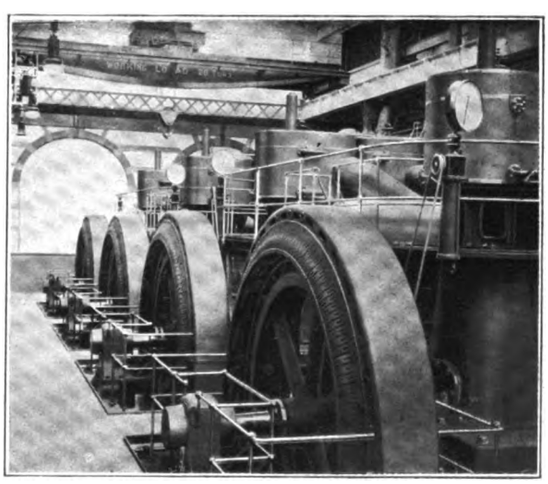

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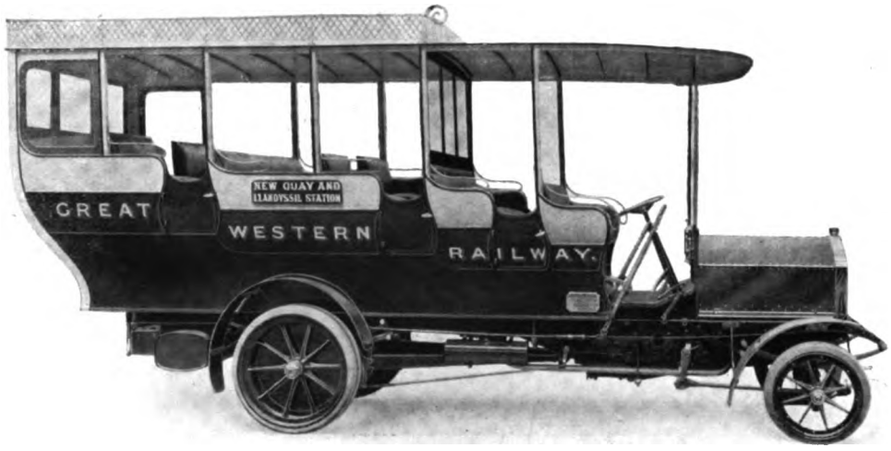

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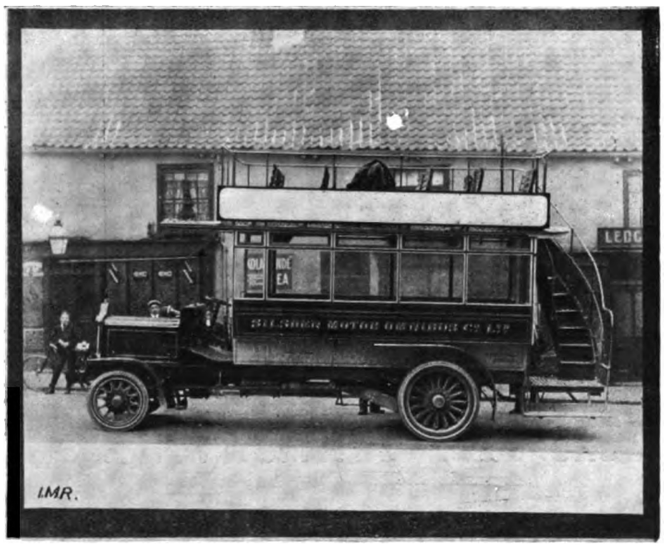
AN OPINION "AFTER 16 MONTHS' CONTINUOUS RUNNING."

SILSDEN MOTOR OMNIBUS CO., LTD.,
nr. Keighley, Yorks., Nov. 13, 1907.

Dear Sirs,

With reference to the Motor Omnibus which you supplied to us in July, 1906, after 16 months' continuous running we are pleased to report to you that the good opinion we at first formed of your 'Bus has been more than justified by results, **and we congratulate ourselves in owning what we consider to be the best 'Bus on the market.** In consumption of Petrol and Oil she is remarkably economical. As to repairs your ledger will disclose that **our purchase of parts, &c., from you during the last six months have not exceeded £5,** which fact speaks volumes for the excellent workmanship of your Chassis. She requires a minimum amount of attention to keep her at concert pitch, and we can always depend on her carrying her complement of passengers (40) with ease up the long and steep gradients so numerous in this locality. We have nothing but unstinted praise for the manner in which your 'Bus has done its work on our country roads since July, 1906.—Yours faithfully,

p. pro **Silsden Motor Omnibus Co., Ltd.**
(Signed) M. P. CRYER, Secretary.



THE 'BUS REFERRED TO ABOVE.

RYKNIELD
MOTOR CO., LTD.,
BURTON-ON-TRENT.

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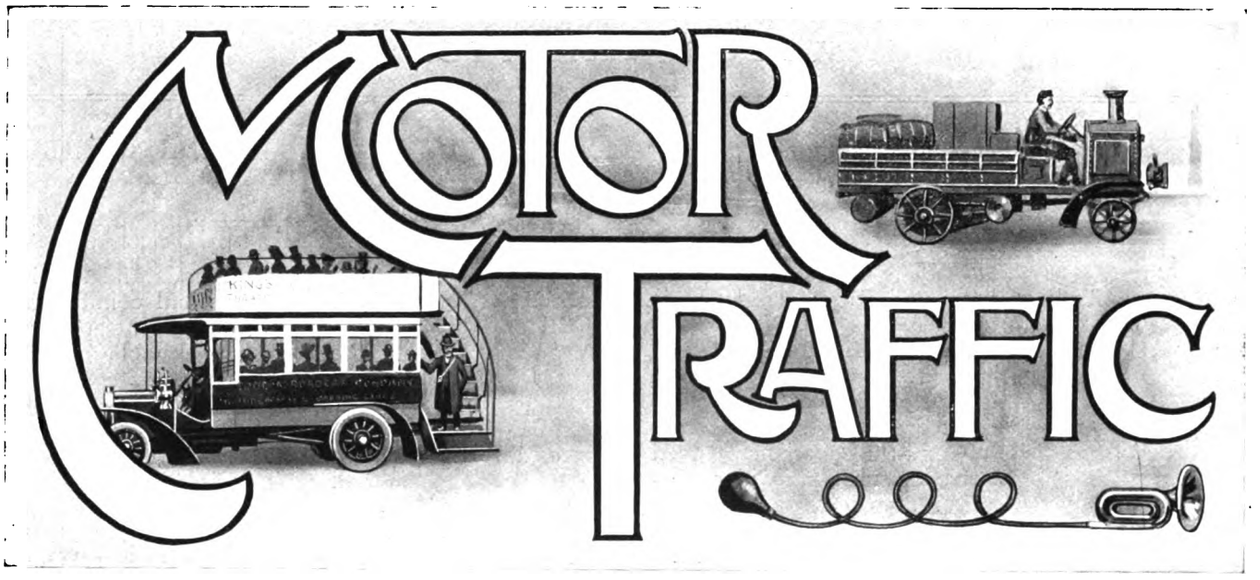

The petrol-electric system for motor omnibuses, which from the first was received with so much favour by engineers and by all who recognise the drawbacks of mechanical change-speed gears, is still being worked upon by various designers. New devices of the kind are being brought out (one of which is described in this issue), and it seems quite probable that some of these will come into extensive commercial use. As an illustration of the probabilities in this direction may be mentioned the successful running for over 10,000 miles on London streets of a petrol-electric 'bus constructed by the British Thomson-Houston Company. It ran under the ordinary London conditions, which are very severe, and fully vindicated its claim to efficiency, economy, and noiselessness. The electric equipment at the end of the test was in first-class condition, and showed no signs of wear. The ideal omnibus, of course, is the purely electric one, but pending demonstration of any vehicle of that sort which can in the long-run be worked at a profit, we welcome the petrol-electric system in which all complicated mechanical details of transmission and gearing are eliminated and the mechanical troubles are confined to the engine and the accessories strictly pertaining to it. Even these mechanical troubles must be minimised when the electric transmission enables it to be run at a uniform speed, irrespective of variations in the load and in the speed of the vehicle.

The question of driving automobile vehicles through the front instead of the back wheels, which was discussed at recent meetings of the Institution of Automobile Engineers, is of interest alike to the owners of pleasure and of commercial cars, and is also of importance to the general public. This chiefly arises from the fact that experiment has shown that a front-driven vehicle is much less liable to side-slip on a greasy surface than a rear-driven one. If the greater part of the weight is put on the front axle, and the work, both of driving and steering, is centred there, the back wheels are simply dragged along in the wake of the steerers and drivers. On the other hand, the front wheels do not show any tendency to slip. Attention is now being directed to the best means of transmitting the power of the engine to the front wheels while still leaving them perfect radial freedom for steering purposes. There is not much trouble in arranging this if electric transmission of the engine power to the road wheels is used, but the problem is a distinct and more difficult one in the case of the ordinary mechanical transmission by shafting and spur gearing. If further experiments show that the front driver is practically immune from side-slip under all conditions, and if it can be shown that there are no accompanying serious drawbacks, the case for its wide adoption will be exceedingly strong.

The strike of drivers and conductors in the employment of the London Road Car Company has come and gone, and while nobody seems to be the better for it, fortunately, nobody is much the worse. The men had no funds to carry on a strike, and in any case they had not a good enough cause. They merely objected to a change under which they will be paid by the journey instead of by the day. But the motor-'bus drivers and conductors in the employment of the other London omnibus companies are paid by the journey, and they have not complained. The Road Car Company will no doubt get better service both out of the 'buses and out of the men, while the latter, it is contended, will not suffer. From any point of view, the strike was a foolish one and it should never have taken place.

The use of motor lorries and vans for trade purposes is extending with considerable rapidity, and growth in this direction would no doubt be accelerated if a larger number of people could definitely grasp what the motor vehicle can and cannot do for them. To take the latter point first, the class of small merchants and manufacturers who only require one or two horse lorries or vans for their business will not be benefited by adopting motor vehicles unless a large extension of their business is in prospect. The running expenses of a motor van are greater than those of a horse van, but the point is that the former can do as much work as several of the latter. If the small man has no prospect of his carrying business increasing materially, then he will do well to stick to his one or two horse vans. But for firms working on a larger scale and owning businesses which are increasing, the motor van and lorry present great advantages. A large number of horses and drivers may be dispensed with, as comparatively few motor vehicles will be needed. Transport and delivery are very much quickened, and the distance of operations is enormously increased. Further, great facilities are afforded for extending the business further and further afield, not only on account of the higher speed, but because all the trouble and

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MOTOR TRAFFIC.

expense inseparable from employing horses on long journeys are abolished. The motor lorry and the motor van are destined to be great instruments in future commercial development.

Many attempts have been, and still are being made to produce a satisfactory resilient wheel which will do away with the necessity for using india-rubber tyres on motor omnibuses and other heavy motor vehicles which run at as high speeds as twelve miles per hour. One such wheel was described in a recent paper read before the Royal Automobile Club, and the experience gained with it promises well. There is probably a wider margin for economy in the matter of wheels than in any other item of expenditure connected with the motor omnibus and van. It is of course self-evident that if a plain steel-tyred wheel could be used the cost of maintenance would be only a fraction of the twopence per mile run usually necessary in the case of rubber tyres. The effort which is being made is to provide a reliable wheel with a steel tyre but with an elasticity in its construction which will deaden vibration without wasting power in the case of the driving wheels. A wheel of this sort, even approximately perfect, will largely solve the problem of the commercial motor vehicle.

Los Angeles, in California, is a city which has come through great vicissitudes in the matter of local passenger transportation. Years ago it was the scene of an exploitation of the cable system of tramways which was not justified, as the traffic was not sufficient to warrant the great expenditure which was incurred. In later years the cable tramways gave way to the electric system, and the overhead wires have not altogether destroyed the natural beauties of the place. As a third movement, it is now announced that a company, with a capital of £200,000 has been formed in California for the purpose of working motor omnibuses in Los Angeles. Petrol, at all events, should be plentiful for the purpose, as one of the complaints of the inhabitants not so long ago was that, owing to the careless way in which the petroleum wells were being opened and worked among the hills adjoining the town, the crude oil was running down into the streets and destroying the amenity of a city of which the inhabitants are proud.

New Chairman of Motor Union.—At a meeting of the Motor Union of Great Britain and Ireland, held in London on January 29, Mr. Joynson-Hicks was unanimously elected chairman. The new chairman is well-known in the cities of London and Manchester, and is a leading authority on all questions affecting motor traction. A member of the legal profession, he is already known to public life, and is regarded as one of the coming men in the political world. At the General Election he stood in opposition to Mr. Winston Churchill for one of the divisions of Manchester.

Ayrshire Roads and Motor Traffic.—At a meeting of Ayr District Committee on January 21, the road surveyor stated that 90 out of the 170 miles of turnpike roads in the district were directly affected by motor traffic, and to meet the increased wear of this traffic he estimated that additional metal to the extent of 2,000 cubic yards would be required. He suggested the obtaining of stone-breaking plant, and an additional road roller. He preferred hand-broken metal—the relative value he estimated at two to one—but stone-breakers could not be got. Mr. H. M. Poe thought they could get workers if arrangements were made to break the metal at the quarries. It was remitted to the Highways Committee to report on the subject.

THE FUTURE OF THE MOTOR OMNIBUS.

By Frank B. Lea.

In a case of serious illness, the friends and relatives of the patient will often derive no small comfort from the quiet but authoritative reassurance of the specialist, whose experience and knowledge enable him to forecast a return to health under ordinary conditions. The regular medical attendant of the invalid, and other practitioners who may hear of the case and circumstances, also feel that their backs are stiffened in this way to carry out the fight against disease; and it is for support of this kind in another field of labour than medicine that the writer feels indebted to Mr. Duguid for his recent article in the *Daily Mail* upon "Omnibuses as Investments."

As might naturally be expected, Mr. Duguid deals more particularly with the London omnibus services, and, though drawing a gloomy but correct picture of their present conditions, he holds out no small hope of ultimate success and prosperity when once the development stage is passed.

No useful purpose would be served by recrimination or allocating of causes for the very obvious failures to date; it is perhaps even invidious to say that such and such a line of action was bound to end in trouble, and that something else altogether should have been done. Those in command know full well where and how they have made mistakes, and the lessons that have been learnt, though costly, will be remembered, to the advantage of shareholders and public alike now that the pioneering is over. Yet it may do good to point out why better results have not been shown, especially during the past two years. Doubtless, so far at any rate as the motor 'bus is concerned, it might have done better from the outset had there only been less haste in the demand for rapid transit, and in the endeavour to supply this demand by the purchase of crudely-designed and flimsily-constructed vehicles—many, perhaps most, moreover, of foreign make. But how many boards, or even individual directors, have the strength of mind under such conditions to advocate a policy of "festina lente," of waiting six or twelve months before starting a new type of service, such as that of motor 'buses, in order to make sure that their design shall be strong and simple yet efficient, whilst construction shall be rather heavy than light for hard work during long hours?

Nevertheless, this has been one reason why motor 'buses have so far made but a poor show, generally speaking. Still further causes, which Mr. Duguid omitted to enlarge upon, are such as the heavy costs of repairs, which now prove to be far more than was estimated or expected, and are not decreased by the stringent regulations and supervision of the police. Yet it is quite certain that each year in future will see the total cost of working gradually reduced. To begin with, as rubber or rubber substitutes can be obtained more cheaply, so the cost of tyre renewals will drop from 2d. or more per mile, to 1d. or 1½d; fuel—costing now from 1d. to 1¾d. per mile—will decrease to 1d. or less according as heavier spirits or even producer gas and other fuels come into use, and engines of greater economy are designed; less, too, will be spent on general repairs, owing to increased strength and weight put into the mechanism at first.

It is not a difficult matter to show that even one of

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these improvements makes a substantial difference in the net returns of a motor 'bus enterprise. A reduction of ½d. or less in the working cost per mile may mean a respectable dividend on the entire capital. Let not the shareholders, therefore, in any of the omnibus undertakings, consider that the outlook is necessarily and permanently a black one for their interests, more particularly since the demand for motor 'buses has led to their introduction and use. Given sound and businesslike foundations, such as Mr. Duguid shows to be essential, the further development of motor 'buses ought to improve the position of the running companies into one of comparative prosperity, if, indeed, it may not actually be their main redeeming factor.

Take away the hand of mere company promoting in its least acceptable form, and motor 'bus concerns, when properly started and worked, can be shown to pay from the outset.

Mr. Duguid—in his list of what might be termed failures—makes mention of an Edinburgh motor 'bus concern which issued shares to the extent of £33,302. This undertaking, it may be added, went into liquidation within a year. There is no need to say why this happened; the story does not make very attractive reading; but there is a still older motor 'bus undertaking in Edinburgh—the Scottish Motor Traction Company, Limited—which has endeavoured to shape its policy throughout on the lines above advocated, and the results are shown in a modest capital well laid out, substantial income increasing rapidly each year, the promise of more business than can readily be dealt with, and—what is best—a dividend earned and paid from profits that appear to be stable so far as man can foresee.

This, however, has only been achieved by care at the outset in choosing vehicles and routes. It required about twelve months from the inception of the concern until a reasonable number of reliable British-made 'buses could be put on the road, and as long a time became further necessary before the management could definitely point to the best-paying roads and journeys.

London traffic is unique in its way; no other approaches it in character or volume. Yet the London companies find that they have started their fare tariff on too liberal a scale, and that so low a fare as a penny can only be given for a short distance. The cost of stopping and starting is too high for a single passenger who travels perhaps but a few hundred yards, and the large number of passengers available has alone helped the London motor 'bus to pull through as well as it has done.

In the provincial cities of fewer inhabitants and sparser traffic this condition is accentuated; the penny passenger is not wanted at all, for he does not pay to pick up. The further afield a motor 'bus runs, and the more long-distance passengers at high fares that are carried, the better is the return per mile run, and so too the net profit, as the working cost remains practically the same.

Now that this fundamental principle of motor 'bus running has been proved in more than one service, there should be further hope for better returns, as managers find out and accept these methods, not only of decreasing expenses, but also of raising receipts.

These expressions of confidence in a brighter future for the motor 'bus are not intended solely for the shareholder in omnibus undertakings, though he has so far appeared the prominent figure to the public eye. There are also shareholders in British motor 'bus building concerns who have lately suffered perhaps quite as much from want of financial success as their fellow-investors in the operating companies. The past three or four years for the former have been a time of costly experimenting; of building vehicles to plans and designs that go out of date in a year; of heavy alterations and renewals or repairs to running vehicles under guarantee; in short, of continued hope and trust in the ultimate—but long deferred—success of their manufactures in this market.

It is an instructive commentary on the position of the makers to glance through the lists printed in some of the technical motor papers that show the various makes of motor 'buses at present running in London, as compared with those of a year ago. Many have completely gone from the streets, and the list of types or makes successfully running grows small by degrees and beautifully less, though the total number of vehicles increases.

It is, perhaps, excusable to feel some little pride in the fact that though the foreign-built 'buses had at first so great a start of the home-made article, and even now head the list, yet the latter are creeping up steadily in number and remaining in permanent service, despite, or, perhaps, even because of the police restrictions as to noise, control, and safety. There should be in this as strong a ray of hope for the shareholders in our British motor 'bus manufacturing concerns as the writer has tried to show is the case for the operating companies.

THE BRITISH THOMSON-HOUSTON COMPANY'S PETROL ELECTRIC SYSTEM.

The British Thomson-Houston Company's petrol electric system (which was described and illustrated in our issues of March 7 and June 6 last year), applied to a Wolseley motor 'bus has completed a 10,000 mile trial in service with the London General Omnibus Company. This vehicle may be looked upon as a pioneer of this system, as it is the first petrol electric motor 'bus to run satisfactorily for anything approaching this distance in service.

As was to be expected for a new departure of this nature, minor defects became apparent in the course of the trial. These were rectified, and it is interesting to note that the last 3,700 miles were covered without the slightest adjustments being necessary. The actual mileage covered was 10,480 out of a possible 13,390 miles. This may be looked upon as a very good performance, considering that no spares were held in London, and that considerable time was occupied in carefully investigating the few defects that occurred, instead of getting the vehicle on the road again as soon as possible, as would have been the case were it an ordinary vehicle in service.

The consumption of petrol worked out at 4·8 miles to the gallon over the whole trial. This is slightly better than the consumption with the gear-driven 'buses running over the same route—Canning Town to Hammersmith. It should be mentioned that this route is one of the most severe, and includes the congested traffic of Whitechapel Road, Cheapside, Oxford Street, etc., and on the return journey the ascent of Notting Hill. The petrol consumption is, therefore, distinctly good, and conclusively disproves the statement that the petrol electric system is inefficient as compared with direct mechanical drive.

This vehicle was always exceedingly quiet, and although it has run upwards of 15,000 miles, it has not become any more noisy. After the trial the chassis was stripped for inspection, and the electrical equipment was found to be in excellent condition, there being practically no signs of wear.

The Thames Engineering Co. have taken up the manufacture of motor cabs. The vehicle which is being produced has a two-cylinder engine, and it is undergoing thorough tests on the streets.

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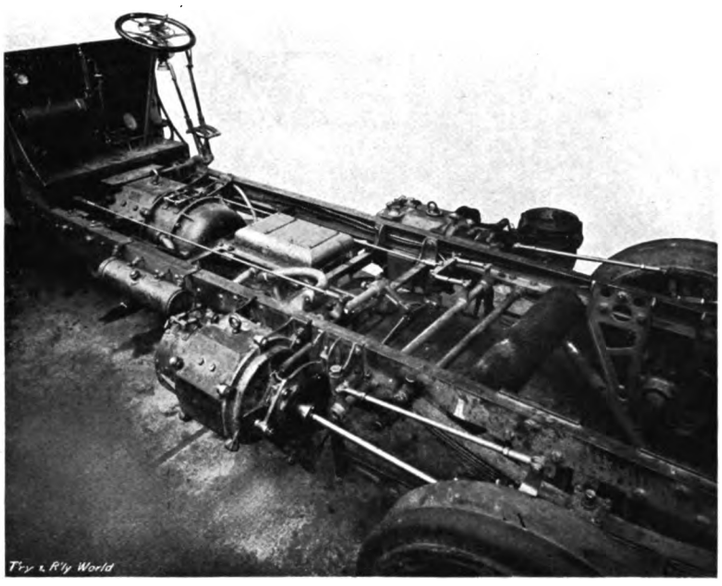
A NEW PETROL-ELECTRIC 'BUS.

Messrs. J. and E. Hall, Limited, Dartford, have supplied to Thomas Tilling, Limited, the London omnibus proprietors, a petrol-electric chassis fitted with a 34-seated omnibus body. The electrical equipment, which is by W. A. Stevens, Limited, Maidstone, differs somewhat from Messrs. Stevens' previous design, which has frequently been described, and presents some interesting features. The petrol engine, the frame, and all the mechanical parts were manufactured by Messrs. Hall, and the design has, in some ways, been modified at the instance of Mr. P. H. Frost Smith, chief motor engineer to Messrs. Tilling. The general arrangement of the chassis is clearly shown in the accompanying illustrations. The engine is similar to that which was entered by



Chassis of Hall-Stevens 'Bus.

Messrs. Hall in the recent reliability trials, and which was described in our issue of December 5 last. It has four cylinders, each of 110 mm. bore by 140 mm. stroke, and runs at speeds up to 1,050 r.p.m. It is rated at 30 B.H.P.

The dynamo, which is connected to the fly-wheel of the engine by a flexible coupling, is completely enclosed, and weighs about 8 cwt. The suspension from the frame is so arranged that the dynamo can readily be removed without disturbing any of the other mechanism. Ventilation is secured by a fan. In brief detail the machine is four-pole, shunt-wound, and produces 200 amperes at 180 volts. By means of inter-poles sparking is prevented, no matter how the load varies.

There are two motors, mounted longitudinally, one on each side of the frame, and carried outside. Each one drives one of the road wheels through a telescopic universal joint, a short shaft, another universal joint, and a worm gear with a 12 to 1 ratio. The back axle is "dead," each wheel being driven separately by its own motor. Thus, from first to last, all spur wheel gearing is eliminated, and accessibility is secured. The worm gearing is securely cased in. The worm wheel, which is of phosphor-bronze, is carried on a housing supported on ball bearings, and it is connected to the road wheel by a dog clutch, admitting of the road wheel being readily removed. The worm, which is of hardened steel, is also provided with ball bearings. A water-cooled brake drum is mounted on each motor shaft close to the motor, and expanding brakes act on the insides of the rims of the road wheels. The motors are four-pole, series-wound, and completely enclosed, and weigh about 3½ cwt. each.

Regarding the electric control, by means of the main controller, worked by a side lever, the motors can be placed in series and in parallel. The field strength of the generator is varied by a rheostat operated by a small lever moving on a quadrant on the steering wheel. The speed of the engine is regulated by a throttle lever which works in connection with the engine governor, and an accelerator pedal, by which the throttle can be opened, irrespective of the position of the throttle lever. Owing to the two speeds given by the motors, series and parallel, the voltage control of the dynamo, and the throttling gear on the engine, a wide range of speeds can be obtained. In nearly all circumstances the controller can be kept in the parallel position.

Owing to the small number of steps in the controller, its construction differs somewhat from that of a tramcar controller. The instrument, which is placed under the driver's seat, consists of an inner and outer ring of metallic contacts. Over the contacts moves a four-arm switch carrying brushes for completing the circuit between the two rings of contacts. Current is not broken in the controller, but by a main switch, which is worked by a pedal, and is interlocked with the controller lever, so that the lever can only be moved when the main circuit is broken. The main circuit, however, under ordinary conditions does not need to be broken, the speed being regulated by the accelerator pedal and the field switch.

When the 'bus is being started from rest, the controller lever is put into the parallel notch, the engine is run slowly, and the dynamo has its field low. The engine is then accelerated by opening the throttle by means of the pedal. The voltage of the dynamo accordingly rises, and this action is increased by gradually moving over the field switch as the vehicle gains speed. The running speed is controlled by the throttle pedal. When a stoppage is to be made, the throttle pedal is released, the dynamo field weakened, and the brake applied.

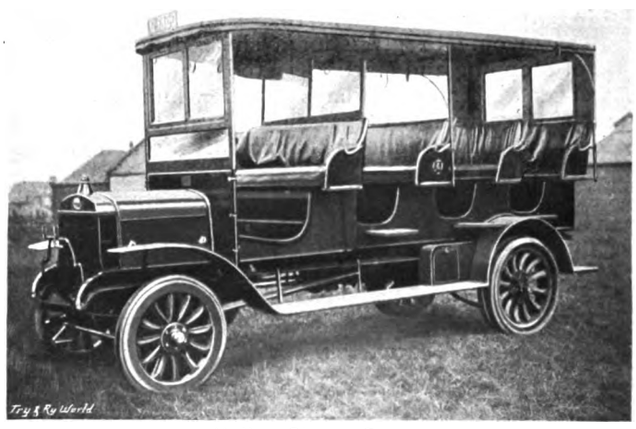
The estimates of economy from the use of this type of transmission, formed by those who are associated with it, are sanguine, as may be seen from the following comparison of the items which will be affected.

	Per 'Bus Mile—Pence. Gear Driven.	Petrol-Electric.
Depreciation	1·375	1·000
Running	0·666	0·333
Maintenance	2·500	0·666
Grease, oil, etc.	0·350	0·175
	4·891	2·174

The running of the 'bus is characterised by the same smoothness and silence which are observable in the case of other petrol-electric systems.

A HALLEY CHAR-A-BANC FOR IRELAND.

The accompanying illustration shows a 15-seated 20 H.P. char-a-banc which has recently been supplied to the Irish Motor Service Company by Halley's Industrial Motors, Limited, Yoker, Glasgow. The vehicle can attain a top speed of 16 miles per hour, and it will be seen that from the passengers' point of view it is very conveniently arranged and well fitted up. The chassis is identical in design with one which



Halley Char-a-Banc.

at the last Royal Automobile Club reliability trials was awarded a silver medal for simplicity of design, accessibility, and reliability. That the char-a-banc is giving satisfaction to its owners is shown by the fact that Messrs. Halley have received a repeat order from the same company for another and larger machine of 30 H.P., and seated for 20 passengers.

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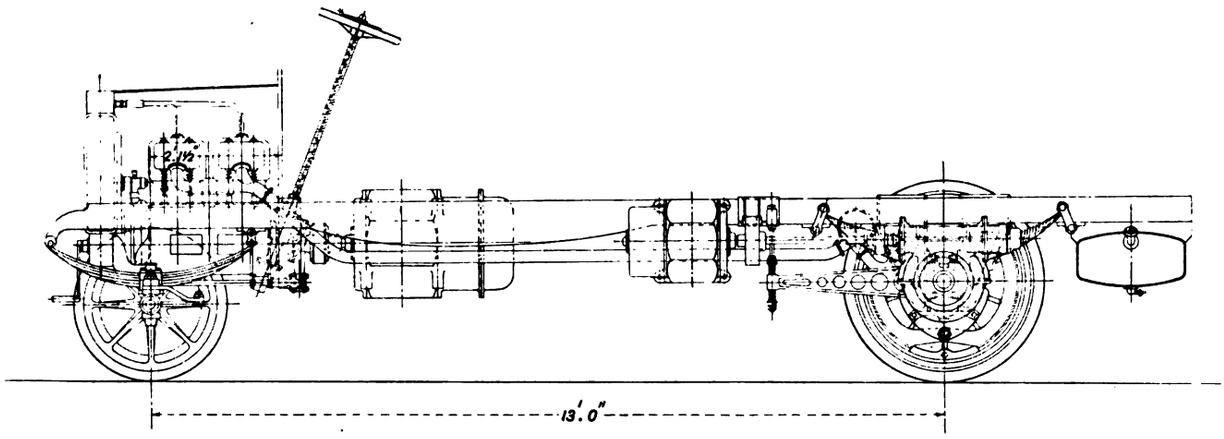

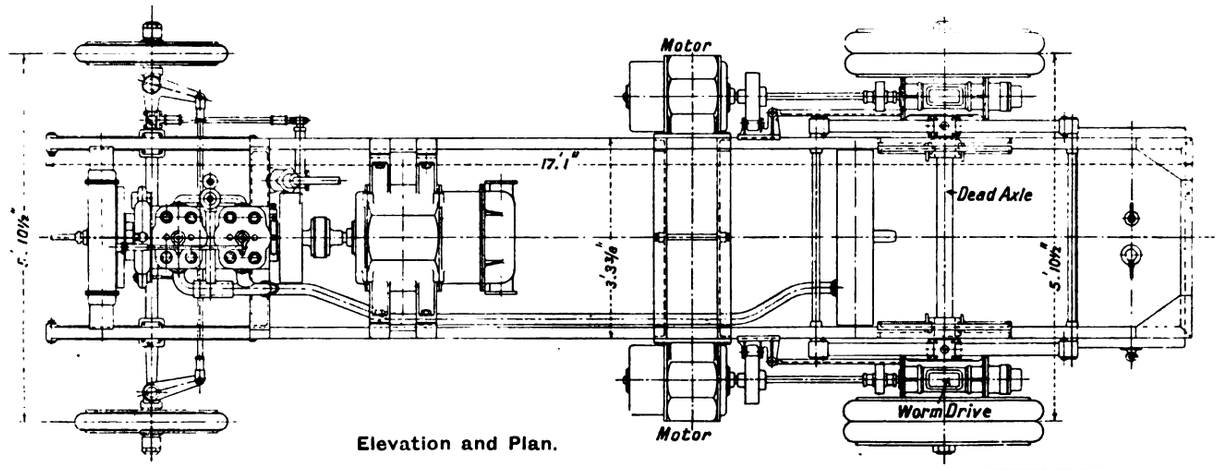

Elevation and Plan.

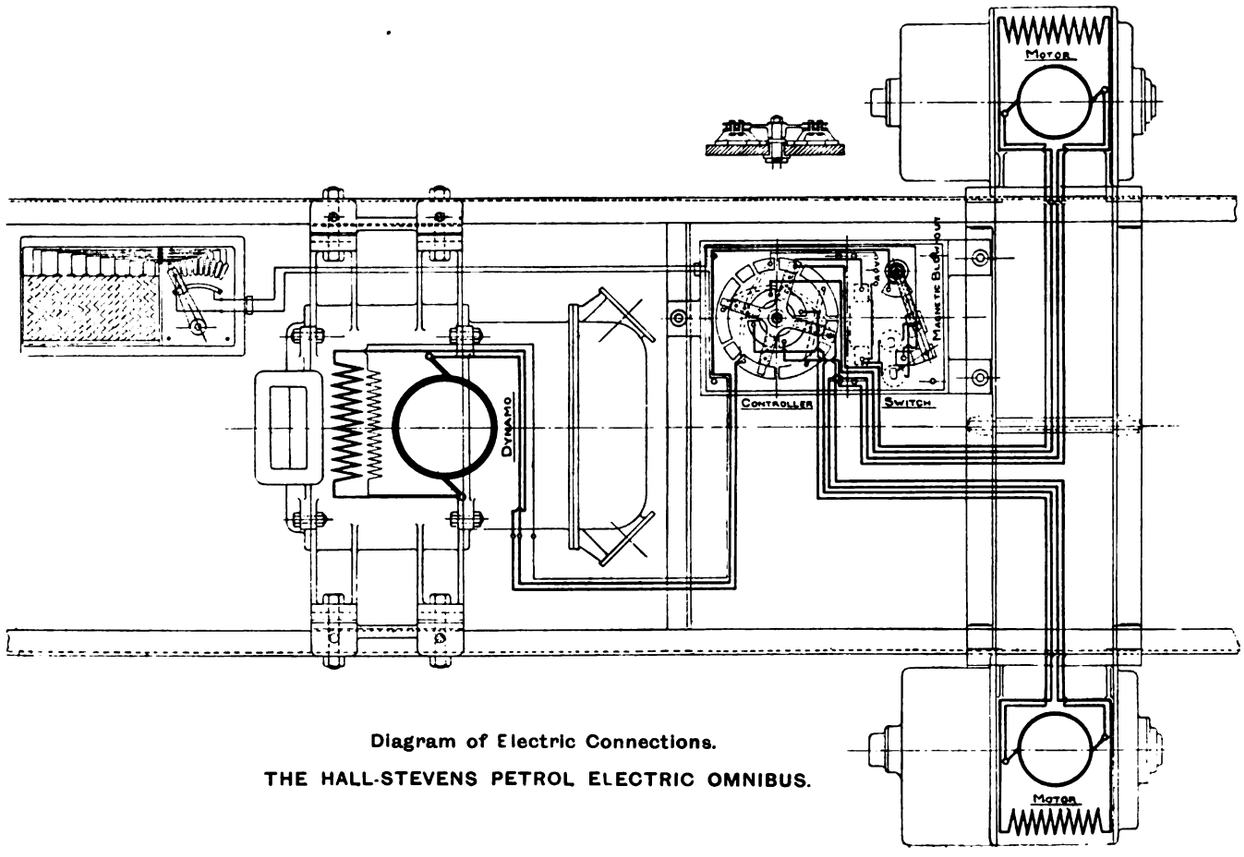

Diagram of Electric Connections.

THE HALL-STEVENS PETROL ELECTRIC OMNIBUS.

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FRONT DRIVING OF MOTOR VEHICLES.

At a meeting of the Institution of Automobile Engineers, held in London on January 22, Dr. H. S. Hele-Shaw, F.R.S., read a paper on "Front driving, with special reference to electric and hydraulic transmission." He first pointed out that given level ground, even surface, uniform velocity of motion, and a rigid framework for the vehicle, it did not matter whether propulsion was obtained through the front wheels or through the rear wheels of a motor vehicle. Whenever these conditions were departed from there were differences, often very considerable, between the two methods. Besides that, as starting and accelerating were usually more rapid than retardation and stopping, the construction and design of a vehicle could be lighter with front than with rear driving. In climbing hills, also, there were theoretical advantages in front driving. In regard to the trouble of side-slipping, both theory and experiment showed that side-slip might be almost entirely prevented by applying the brakes to the front wheels. It was easy to understand that so long as the vehicle was being propelled by the front wheels, the vehicle as a whole would follow the tracks of the front wheels, and would not be inclined to skid. But it was not so easy to understand what happened when the brake was applied to the front wheels. It only needed a simple experiment to demonstrate that, whereas a wheel when running free tended to move most easily in the direction of its plane of rotation, when the brake was applied the exact opposite was the case, and it was much easier for a wheel on a greasy surface to slip sideways than to move forward in its own plane. The result was that, if the brake was applied on the front wheels, any tendency to slip might be checked by the driver adroitly using his steering wheel, the hind wheels, which were free running, following in the direction of the vehicle, without any tendency of the mass of the vehicle to swerve sideways. If, however, the brake was applied to the back wheels, it became an extremely difficult thing to prevent side-slip taking place. With the assistance of the Krieger Company, he had carried out experiments with both front and back-driven electric vehicles, with different distributions of the load. A slippery patch was provided by spreading soft soap on a concrete floor. The experiments demonstrated conclusively the superiority of the front-driven vehicle both in driving and steering on a slippery surface. On the brakes being applied, the front-driver held on its course in a straight line, but the rear-driver had some severe sideslips. The front-driver was also more under control when an attempt was made to change its course. The front-driver had a weight of 20 cwt. 35 lb. on the front wheels, and 11 cwt. 77 lbs. on the back wheels. On changing the distribution so that there was 15 cwt. 35 lbs. on the front wheels and 16 cwt. 77 lb. on the back wheels, the vehicle was much less under control, and evinced a little tendency to side-slip. The tractive power on the slippery patch was markedly reduced. The author then proceeded to describe the system of direct driving of the front wheels of the Krieger car by two electric motors. With regard to heavy vehicles, he did not know of any attempts at the electrical driving of the front wheels alone, but there certainly had been numerous examples of construction of vehicles in America in which the electrical driving of all four wheels had been adopted. Examples of these were the Imperial electric four-motor drive and the Michigan four-wheel drive vehicle. The arguments were very strong in favour of the employment of four-wheel-driven vehicles by municipalities which had abundant supply of electric power, and required working operation over a short radius. He could not help thinking that this system had a great future in its application to heavy vehicles. Apart from prevention of side-slip, there were special advantages in the case of such vehicles running in great cities with paved streets, where not only was manœuvring of great importance, but where rubber tyres were highly desirable, both to save the vehicle from shocks and to diminish the noise. Further, the saving not only on tyres, but also on the vehicles, which might have to be accelerated or retarded, possibly hundreds of times in a day, would be found to be so great as to far more than outweigh the additional cost of four-wheeled propulsion. With regard to hydraulic transmission and front-driving, he did not think such a system was very practical for light and fast-moving vehicles. The case might be quite different, however, in the case of slowly-moving vehicles, especially where rubber tyres could be used. It was quite mechanically feasible to place within the wheels a strong and compactly built hydraulic motor, which, if using oil as the working fluid, would be very little affected by shocks and vibrations. Experience with the Hall hydraulic gear had shown how little affected such a motor was by, and how well it continued to work in spite of, severe and continued concussions. The experience gained in this connection had shown that the durability of such a motor was practically unlimited, and there was every reason to believe that it would wear for an almost indefinite period under a working pressure of as much as a ton on the square inch. As for the transmission of liquid for such a motor, it was easy to see how the supply and exhaust passages could be made through the swivel pin of the steering wheel, a petrol motor driving an oil pump on the framework of the vehicle itself.

At the same meeting Mr. R. W. Harvey Bailey read a paper on "The Front Driving of Steam and Petrol Vehicles." In this he pointed out that the more recent attempts to devise a satisfactory front-driving front-steering vehicle had been made solely to meet a difficulty associated with the rear-driven car. The latter type was mechanically incorrect as, under certain road surface conditions, it was quite uncontrollable. The propelling force in the case of a rear driver was parallel in direction to the centre line of the car, whereas the front wheels were set at an angle to this direction varying to suit the exigencies of the moment. If any external forces set the vehicle moving laterally, the propelling force increased the deflection. A front-driving rear-steering vehicle was in no better case. But the design of the front-driving front-steering car was mechanically correct, as the propelling forces were always in the proposed line of travel, and so tended to stability and to the prevention of skidding. Mr. Bailey proceeded to detail the principles upon which Dr. Brightmore, late head of the engineering department of the Royal Indian College, proceeded in his work on the front-driving front-steering heavy steam vehicle. So far as Mr. Bailey knew, the Brightmore vehicles were the only ones that had seriously tackled the question. These three experimental cars had been very successful, though considerable difficulty had been found in ensuring stability when running backward. All the mechanism was carried on a fore carriage, which was pivoted by a large ball and socket bearing, and supported at the back by a runner which travelled in a quadrant of channel section bolted to the body of the vehicle. The whole of the fore carriage revolved. The front road wheels ran loose on the live axle, which was driven by chains. The wheels were indirectly connected to the axle by pawls geared into ratchet wheels, which were keyed to the axle. By a special mechanism it was possible to engage or disengage either pawl. The disengaging of the pawl was effected by applying a hand brake to a friction pulley, and at the same time the freed wheel was slowed down. Later this arrangement was modified by using an ordinary differential gear and steering by applying a brake to one side or other of the gear. The author subsequently described the Pullcar vehicles as typical of petrol front-driving front-steering cars. In the Pullcar the engine, gears, tanks, etc., were carried on the vehicle proper. An axle was used which steered on the ordinary Ackerman principle, but the pivots on which the stub axles turned were divided, each consisting of two pins which were concentric, but not extending across the intersection of their common axis with the axis of the driving member of the axle. At this point of intersection a universal joint was arranged to join up a short driving axle with the driving shaft. The ends of the axle proper instead of carrying the road wheels had arms cast on them vertically, and then extended laterally to carry two short steering pivots. These pivots formed the hinges for a hollow stub axle. The road wheels ran on ball bearings carried on the outside of the stub axles, while the power was transmitted to the wheels by short driving spindles keyed into the bosses of the road wheel hubs, and on the pivot side were formed as a plain jaw. The driving spindle from the differential gear was formed into a similar jaw arranged at 90 degrees to the other, while between the pair of jaws a loose floating rectangular block was arranged to act as a universal joint. This was a notable feature and left nothing to be desired as regarded simplicity or accessibility.

"A Terrible Machine."—At Clerkenwell Police Court, on January 3, Mr. d'Eyncourt, the magistrate, passed sentence of a month's imprisonment on T. Greetham, a motor 'bus driver, for having been drunk while in charge of the 'bus. In doing so the magistrate said: I won't treat it as an ordinary case of drunkenness. You were responsible for the management of a terrible machine, and it was imperative that you should be sober. You will not only go to prison, but will have your licence revoked also. I shall always, in similar cases, send drunken motor-drivers to prison. Mr. H. Ricketts later made an appeal on behalf of the defendant. He pointed out that Greetham was driving on a bitterly cold day between Hornsey and Kensington. When one remembered how difficult it was to keep even reasonably warm on foot he would realize how terribly motor-drivers would suffer in such weather. Had the defendant been in ordinary health he would not have been affected by the drink he took. He had, however, previously suffered from a chill. Mr. d'Eyncourt: I am very sorry for the individual, but in cases of people who drive motors, whether rich or poor, I will punish drunkenness with imprisonment without exception, for they are managing a perfectly deadly engine which must be kept under careful control.

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RESILIENT ROAD WHEELS.

"Resilient road wheels and their economic relation to the automobile," was the subject of a paper read to the members of the Royal Automobile Club, by Mr. G. Stuart Ogilvie, on January 9. In the course of this he contended that the automobile, exclusive of the tyre bill, was the cheapest form of land locomotion known to man. In support of this he quoted figures to show how low was the cost of mechanical upkeep per ton-mile, apart from tyres, and how enormous was the cost of tyre maintenance, whether the tyres were pneumatic or solid india-rubber. What was wanted was a resilient wheel, which should fulfil the following conditions: 1. The wheel must possess stability—lateral and circumferential. 2. It must absorb vibration. 3. It must yield to concussion. 4. It must be durable, and therefore economic. 5. It must be simple of design, accessible of detail, and easy to repair. 6. It must *not*, when power-driven, convey the torque of the engine through its primary resilient medium. 7. It must convey this torque through a secondary resilient medium. 8. It must distribute the axle weight over as wide a superficies of resilient material as possible. 9. It must "sit down on the road"—that is to say, resilience must be obtained without the tread of the wheel losing its friction drive off the road surface. 10. It must give fair warning of approaching collapse arising from wear or accident. 11. It must be easy of draught. 12. It must be silent in running.

He proceeded to describe the spring device called the "Vieo" wheel. It involved a principle which was far from new, namely, a floating rim with some form of resilient medium between the rim and the hub member. Past inventions of the kind had been failures, because allowance had not been made for the circumferential as well as the vertical movement of the inflexible rim floating on its hub member. Without such an allowance no pivotal action was possible, and the wheel became at certain periods of each revolution a rigid wheel. The circumferential allowance was the novelty of the Vieo wheel. The Vieo buffer stop also gave a spring drive independent of, but co-ordinating with the action oi the primary resilient medium. The latter consisted of a series of rubber rollers in a race between the rim and the hub member. On account of the eccentricity of the rim and the felloe of the hub, the buffer stops came successively into engagement with corresponding drivers attached to the rim at a practically definite point of revolution of the wheel. While there was always a direct drive between the parts, this was achieved without detrimentally affecting the resilience of the wheel or its power of accommodating itself to the varying surfaces encountered on ordinary roads. Extreme lateral rigidity was secured by this method of correlation. In the case of a driving-wheel, in which the felloe stop encountered and drove the floating rim stop or driver, the arc of contact of the stops was in the forward half of the wheel in the direction of the tread, the stops coming into engagement at about 1.30 (regarding the outside of the wheel as a clock face), and disengaging about 4 30. When a driving wheel encountered an obstacle, the first result of the joint effect of the driving and resisting forces was a yielding of the buffer stops and a simultaneous pivotal movement of the rim about the pair of stops then in engagement, and, during the pivotal movement, part of the weight of the car, usually supported on the lowest point of the rim, was thrown upon the forward rim stop, with the result that, in addition to the driving effort, the weight of the car itself assisted the wheel to over-ride the obstacle.

The author subsequently gave results of his own prolonged experience with wheels of this type on high-speed cars. The cost of repairs and maintenance for a pair of Vieo wheels during 10,110 car miles or 21,250 power-driven ton-miles worked out at 2¼d. per car mile or 1d. per power-driven ton-mile. The relative cost of pneumatic tyres was 6½d. and 3d. respectively. Mr. Ogilvie also cited the case of a pair of 42 in. iron-shod Vieo Corry wheels which had run over 40,000 power-driven ton-miles, at an average speed of eight miles an hour, and with an axle weight loaded of 4¾ tons. These wheels ran for 115 weeks, covering 9,527 car miles without a single involuntary stop due to these wheels. The lorry was chiefly employed delivering steel girders. Two similar lorries with solid artillery wheels, doing the same work, required to have their wheels renewed three times during the same period. Comparing the cost of upkeep of wheels with that in the case of a lorry fitted with solid rubber tyres, the cost for Vieo wheels was ⅝d. per car mile, while that for the rubber-tyred wheels was 8½d. The corresponding figures per ton-mile were respectively $\frac{1}{10}$d. and 1¾d.

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MOTOR TRAFFIC.

STRIKE OF MOTOR 'BUS MEN.

On January 2 a serious strike, involving about 1,200 men—drivers, conductors, and mechanics—in the employment of the London Road Car Company, was begun. The result was an almost complete cessation of the company's motor 'bus traffic, the number of vehicles affected being nearly 200. The London General and the Vanguard Omnibus Companies pay the drivers and conductors of motor 'buses so much per journey, while the Road Car Company have hitherto adhered to the old system of paying the men by the day. The Road Car Company now proposed to come into line with the other two companies and to pay their men by the journey. To this the men strenuously objected. The daily wage of drivers has been 6s. to 6s. 6d., while that of conductors has been 4s. 6d. to 5s. Under the new system the drivers are to receive from 1s. 11½d. to 2s. 7d. per journey according to the length of it, and conductors from 1s. 3d. to 1s. 8d. In the event of a breakdown, through no fault of the driver, the men will receive some compensation, but it is not to exceed a rate of 3s. 6d. per day. The drivers and conductors of the company's horse omnibuses are to be paid by the day as hitherto, but their wages are to be reduced by 6d. per day, bringing the driver's wage down to 6s., and the conductor's to 4s. 6d. Notice of this reduction was also given to the horse 'bus drivers and conductors of the London General Omnibus Company. The view put forward by the officials of the Road Car Company was that the changed system of pay would not reduce the earnings of the motor 'bus drivers and conductors, and that in certain cases it would be to their advantage. The object was to induce the men to run as many journeys as possible in the day, so as to secure having a good day's work done. The length of the working day would be increased from about eight hours to between nine-and-a-half and twelve hours. This, it appeared, involves reducing the number of men per two omnibuses from four drivers and four conductors to three drivers and three conductors. On behalf of the men, an official of their trade union pointed out that the journey system was proposed twice last year, and was successfully resisted. The journey payment system meant starvation. The position of the relief men, already bad enough, would become slavery.

On Tuesday, January 7, the directors of the company issued a notice to their drivers and conductors on strike informing them that unless they resumed work on the company's conditions on or before January 9, their licenses would be returned to them, and they would consequently cease to be servants of the company. The secretary of the men's trade union stated that this notice would have no effect on the determination of the men to resist the proposal of the company. On January 8 the London Labour Conciliation and Arbitration Board offered their services, to which the secretary of the men's union replied that if the company promptly withdrew their arbitrary notice the men would not be unwilling to confer with the company's representatives should the latter desire it. The company replied to the offer that they had nothing to arbitrate about, and they declined the proposal. On January 9, when the time allowed by the company's notice expired, only a few of the strikers returned to work, but on the 13th the men began to go back, and a day or two later they had nearly all been reinstated and the complete 'bus sevice restored. One cause of the collapse was the small amount of strike pay available.

MOTOR OMNIBUS NOTES.

Bolton Town Council have agreed to give a six months' trial to a motor 'bus service between Darcy Lever and Brownlow Folds.

Todmorden Corporation motor 'bus service has been in operation for a year, and has resulted in a loss of about £3,000.

Stafford Motor Service and Supply Company.—This company has been registered with a capital of £5,000 in £1 shares, to carry on the business of motor car, omnibus, van, and cab proprietors.

Birmingham Motor Cabs.—Birmingham Watch Committee have agreed to license motor cabs, subject to the vehicles being passed by the Committee's expert, and to regulations being complied with.

Cab Fares in Sheffield.—Sheffield Watch Committee, in granting licenses for running motor cabs, have made it a condition that the fares are not to be lower than those hitherto in force for horse cabs.

Bradford Motor Cabs.—The Northern Motor Cab and Transport Company, Bradford, have begun the running of motor cabs in that town. A start was made with three cabs in the middle of January, and the number will be increased in accordance with the demand.

Motor Cabs for Edinburgh.—Messrs. John Croall and Sons, carriage and cab proprietors, Edinburgh, are about to start taximeter motor cabs in the Scotch capital. The vehicles will be landaulettes of Argyll make. They can each seat three passengers.

180 Kilometres an Hour.—It is reported from Paris that the F.I.A.T. Company have built at Turin a motor car of 200 H.P., capable of maintaining an average speed of 180 kilometres (112 miles) an hour. The car is to be used for racing at Brooklands in England and elsewhere.

The Society of Motor Manufacturers and Traders have made great progress with their scheme of organising local agents' sections all over the country. By means of this detail organisation it is hoped that the interests of all motor manufacturers and agents in Britain will be conserved and promoted.

Railway 'Buses.—The Midland Railway Company are starting a motor 'bus service between Desborough and Rothwell in Northamptonshire. Single-deck vehicles of Wolseley-Siddeley and Maudslay makes are being used. The Great Western Railway Company have decided to run omnibuses over additional routes in Wales.

The Société Anonyme des Taxi-Autos De Dion Bouton has been formed in Paris with a capital of 2,000,000 francs, with the object of running motor cabs on a large scale in Paris and elsewhere. The fares are to be lower than have obtained hitherto. The daily working expenses per cab are estimated at from 13 to 14 francs, and the receipts are put at 35 francs.

Motor Vehicles in London.—According to statistics prepared by the Metropolitan police, the number of motor omnibuses licensed during 1907 was 1,205, being an increase of 422 over the number licensed in 1906. The horse 'buses licensed last year numbered 2,557, being a decrease of 407. In 1907 the number of motor cabs licensed was 723, and of horse cabs 9,818. In the preceding year the corresponding figures were 96 and 10,492.

London General Omnibus Company.—The directors' statement shows that the company's business from July 1 to December 3, resulted in a serious loss, and they very much regret that in consequence of this it was impossible to pay the dividend due on the five per cent. preference shares on January 1. It may be recalled that for the first half of 1907 there was a loss on working of £52,413, and it was only by drawing on the reserve fund that the preference dividend was paid. Dividends were paid regularly on the ordinary stock down to June, 1906. During the six months just ended the traffic receipts showed a falling off of about £50,000. Loss on motor omnibus experiments, and competition by other motor 'bus companies and by the extension of electric railways and tramways, are no doubt the main causes of the present unfortunate position of affairs.

The Vienna Omnibus Undertaking.—It is reported from Vienna that the principal creditors of the Vienna General Omnibus Company, having come to the conclusion that the position is not so bad as it was at first considered, are now about to organise a syndicate which will take over the whole business and start it afresh on the same lines as before. The leading firms in the new syndicate are Hauser's, horse-dealers, of Vienna, and Grunfeld's, well-known wheat merchants. In the meantime the negotiations with the muuicipality are to be continued, and the receiver of the old company has been invited to furnish at the earliest possible moment an exact statement, with balance sheet, and also fresh proposals for presentation to the municipality. Judging, however, from what has already transpired, the municipal authorities seem but little inclined to take over the business, and the Burgomaster is even of opinion that it would probably be more advantageous to entirely abandon the horse-traction system and to replace it, as far as possible, by electric tramways, although this would necessitate a great deal of expensive expropriation.

A London Accident.—On January 8 a steam omnibus collided with suspended scaffolding under a railway bridge in the Grove, Hammersmith, and two workmen were thrown from their perch to the roadway. Both men were seriously injured, and one of them, named George Hockymore, subsequently died in hospital. An inquest was held on January 17, when it was stated in evidence that the scaffolding was 11 feet from the ground, and projected into the roadway about 6 ft. 6 in. A red flag was suspended from the scaffolding as a warning to vehicular traffic. For the omnibus company it was contended that the flag was insufficient to warn the public. Other witnesses said the 'bus was empty at the time and was being got ready for traffic. The estimates of the speed varied, one being 12 miles an hour, and another between 3 and 4 miles an hour. The driver stated that he saw the scaffolding on the path, but not over the roadway, and he did not see the red flag. A police sergeant did not think sufficient precautions were taken to warn vehicular traffic. The jury returned a verdict of accidental death, and stated that they did not consider that the driver of the 'bus exercised sufficient precautions while proceeding under the structure.

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THE Tramway & Railway World
A REVIEW OF CURRENT PROGRESS IN ELECTRIC AND OTHER TRACTION

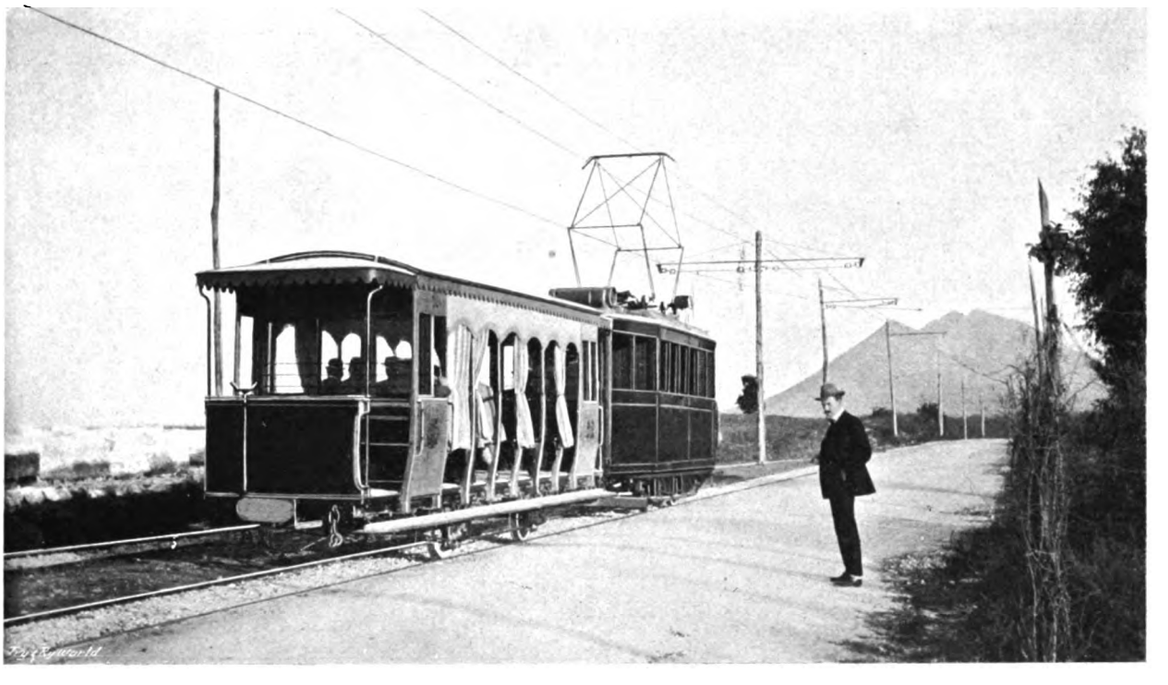
ESTABLISHED 1892. LONDON, MARCH 5, 1908. VOL. XXIII.

THE ROME-CIVITA CASTELLANA ELECTRIC RAILWAY.

THE FIRST SINGLE-PHASE LINE BUILT IN ITALY.

This light railway, which has now been in successful operation for a year, was the first single-phase line built in Italy. The object which the "Societa Anonima della Tramvia Roma-Civita Castellana," its proprietors, had in view in its construction was to provide good traffic facilities in the entirely unserved district lying north of the Tiber and between it and the Rome-Viterbo Railway, which lies to the north-west at a mean distance from it of about 15·5 miles, the only other line being the Rome-Florence Railway lying south of the Tiber. The district itself includes a rich agricultural zone of about 123,500 acres, with a population, excluding city and suburban dwellers, of about 40,000. Several places of picturesque and historic interest on the route make it a favourite one for tourists, who have hitherto been conveyed by coach or on horseback. These include Castel Nuovo, Mount Soracte, the monastery of San Silvestro, and Civita Castellana itself, with its Etruscan temple, tombs, and renaissance works of art. The railway company are, furthermore, proprietors of valuable marble quarries in the district.

The southern terminus of the line is in the Plaza della Liberta, Rome, within the city boundaries. From this point 2·7 miles are constructed for urban service as a tramway, and the remaining length of 30·5 miles to Civita Castellana as a light railway. For about eight miles along the Tiber the line is practically level. Thence there is a continuous gradient for over 9 miles, including one of 4·7 per cent. Beyond Castel Nuovo, the "half-way house" and the highest point on the route, the line drops almost continuously until the ascent to Civita Castellana is reached, where it rises by gradients varying between 1·5 per cent. and 4 per cent., the maximum being 7·2 per cent. for about 1,650 ft. entering the town.



Train on the Rome-Civita Castellana Railway—Mount Soracte in the Background.

The passenger traffic, which averages about a

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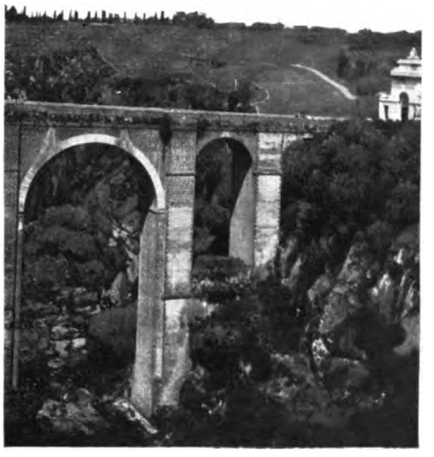
thousand per day, is served in the urban district by motor and trailer car every 15 minutes, and in the country by four trains in both directions per day. Goods trains are hauled by electric locomotives.

The gauge of the line is one metre. In the suburban section, Vignole rails, 39 ft. 7 in. long, weighing 46 lbs. per metre, are laid. They are fixed on rectangular sleepers of 4·6 in. by 5 in. cross section, and 5 ft. 11¼ in. long. On the urban line, Broca type rails, weighing 56 lb. per metre, are used. These rails are electrically connected under the fish plates by bonds of the "Chicago" type, having a section of 50 sq. mm.



The Approach to Civita Castellana.

The trolley line is divided into high and low-tension sections. The high-tension section, 6,500 volts, starts from the generating station at the Race Course (Tor de Quinto), near Ponte Milvio, about three miles from Rome, and ends at Civita Castellana. From the Plaza della Liberta terminus to the generating station the tension is 600 volts.

THE HIGH-TENSION OVERHEAD EQUIPMENT.

The high-tension line is of 50 sq. mm. copper wire, without feeders, this having been found sufficient for the service. The most severe condition which can be met with is the simultaneous running of two trains on the 4·7 and 7·2 per cent. gradients respectively. The power loss would be then slightly less than 10 per cent., rising to 11·5 per cent. when starting on the 7·2 per cent. gradient. The trolley wire is suspended over the line, 19 ft. 9½ in. above the level of the track, from angle iron brackets fastened to wooden poles. These poles are of chestnut, and have a diameter at the base of 10·5 in. On straight runs they are placed at a maximum distance of 125 ft., and on curves at a distance varying from 41 ft. to 112 ft. according to the radius, and are fixed in concrete. The following are a few of the guiding principles adopted in the construction of the overhead line: Great flexibility to prevent the trolley shaking; double safety arrangement to prevent the trolley wire falling in case of fracture, and to make it dead if a breakage should take place; points and sections combined by means of special apparatus; double insulation, each being sufficient to withstand the line pressure. To reduce as much as possible the expense of first installation, the line has been equipped with safety devices only at the points of suspension; and the catenary line construction has been adopted only on entering Civita Castellana.

Map of the Route—Shown by Broken Line.

Mount Soracte from the Electric Railway Station.

The Campagna as seen from the Railway during a Flood.

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The trolley wire has two lateral grooves, and is supported by a strong clamp, fixed to a flat transverse base of iron about 3 ft. 3 in. long on the straight portion of the line, and 5 feet on the curves. A galvanized steel 7-strand cable connects this suspension, first, to a ball strain insulator, then to a heavy insulator, both of porcelain, and capable of withstanding a tension of 30,000 volts. By the system employed the line can never fall in case of the fracture of a porcelain insulator, because of the interlocking metallic parts of these insulators. The danger which would arise from the fall of a live wire has also been reduced to a minimum; the parts more exposed to wear and tear being the points of suspension, a supplementary suspension has been provided. This consists of two small clamps fastened to the trolley wire at about 28 inches apart, and connected together by a steel cable supported upon the main suspension clamp. If a breakage occurs at an intermediate point, a special device breaks the line current automatically and instantaneously. This device consists of a pilot wire of phosphor bronze running all along the line and connected at one end to the trolley wire at the end of the line, and at the other end, at the generating station, to a maximum and minimum release switch, which operates when there is an excessive load or short circuit, or when the line is broken.

Erecting a Section Insulator.

The catenary suspension is as follows: A galvanized steel cable of 0·8 inch diameter, supported by a heavy porcelain insulator fixed on the bracket, is suspended over the trolley wire, and is connected to the latter every 10 feet by means of flexible hangers of special design. On each side of these main insulators there are, on the suspension wire, other porcelain insulators, so as to effect the double insulation of the system from the ground. The attachment of the cable on these insulators has the greatest wear and tear, and has therefore been specially calculated for a safety factor equal to 10.

The line, being constructed for a bow trolley, is stretched in zigzag so as to allow an even wear of the trolley bow. The great elasticity of the line, as well as its careful design on the curves, prevents arcing, an important matter where the trolley wire voltage is 6,500 volts. At crossing points the wires are so arranged that the bow can pass easily from one wire to the other. The only peculiarity they present is that the two wires are insulated from each other by spheres of porcelain, and are connected in series by a return wire of the same cross-section as that of the trolley wire. This arrangement was necessary to have only one circuit; thus the trolley wire of each track is protected in case of the rupture of the pilot wire.

The line is sectioned in ten places near stations, and the various sections are electrically connected by means of horn-type section-break switches. The whole arrangement is supported by two poles with two cross-bars at their tops; the two line wires are insulated by means of two heavy porcelain insulators. A rigid section, 10 feet long, insures the passage of the bow trolley from one section to the other. The two sections of the line are insulated from each other by two porcelain ball insulators. They are also insulated from the dead section, the latter being itself doubly insulated from the ground, thus securing the passage of the trolley without jar and without connecting the two sections in parallel.

A similar arrangement governs the passage from the high to the low-tension section, but a special device automatically operates a switch on the car as soon as the trolley passes under the neutral section. The transformer of the equipment is thus always suitably connected for the tension of the section upon which it enters. Danger of burning the apparatus when passing from low to high-tension is thus avoided. Each section is protected by a lightning arrester of the horn type, connected to the earth through a liquid resistance, and is provided with a double anchor system.

The Overhead Equipment.

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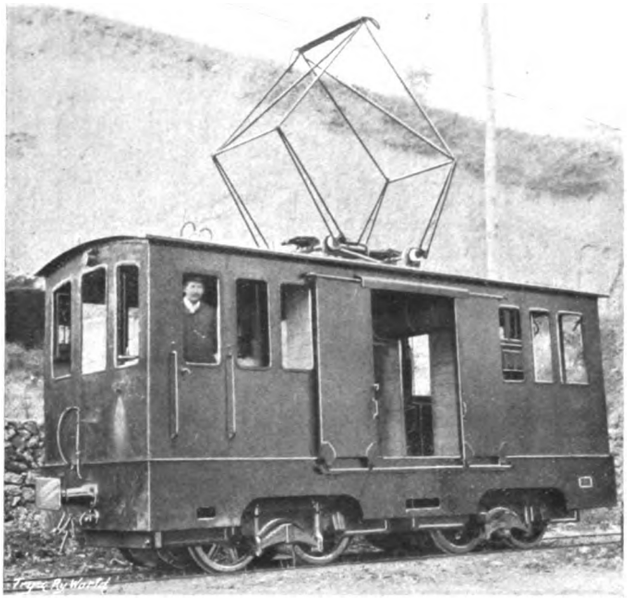
THE LOW-TENSION OVERHEAD EQUIPMENT.

The urban line, at 600 volts pressure, is of copper wire, 60 sq. mm., supported by drawn steel poles of the Mannesmann type. The same principles as for the high-tension section were adopted for the construction of this section, with the exception of the porcelain insulators, which have been replaced by Ambroin insulators similar to those used for direct-current trolley lines. To one interesting point reference must be made, however: this is the crossing of the line by the Rome tramways system at 500 volts direct-current with an ordinary wheel trolley. It was here necessary to design a type of crossing which would give every possible guarantee as to insulation and good operation of the bow trolley.

The direct-current trolley wire runs inside a small channel treated with paraffin, in which the wire is fastened by means of Ambroin clamps. The wheel trolley passes progressively from the height of its wire to that of the edges of the channel by means of two guides fastened to the trolley wire at a short distance from the crossing. The two wires crossing each other at an angle of 45 deg., the passage of the pantagraph bow, from one side to the other of the direct-current wire, is made very simply, as the bow touches the second edges of this channel before it has left the other.



Single-phase Electric Locomotive

THE ROLLING STOCK.

The rolling stock consists of three locomotives, seven 30-passenger motor coaches; several 40-passenger trailers, and a number of 10-ton closed and 8-ton open goods trailers.

The locomotives weigh 20 tons each, have two bogies, and are of the box-car shape, with three windows at each end and three side doors. On the roof are placed the lightning arresters and the apparatus for changing over the connections for operation from either the high or the low-tension sections of the line. The pantagraph trolley operates freely both ways without reversing, and the pressure exerted against the line is from 8 to 10 lbs. The Westinghouse air brake is used throughout.

The electrical connections of a single-phase locomotive with four motors are shown in the diagram on page 179. The high-tension current collected by the pantagraph trolley passes first through a fuse, and then through the winding of the transformer and goes to earth. Between point A and earth there is thus a difference of potential which decreases progressively from 6,500 volts to zero. Each motor has one of its terminals grounded, and they operate always in parallel.

Between earth and tap H there is a difference of potential of 100 volts. Tap H serves to feed the lighting circuit, which carries 5 incandescent lamps connected in parallel. At this point is also connected the electric motor for the air compressor (of the same type as the 40 H.P. motors) of 3·3 H.P., single-phase, 100 volts, 25 periods.

The air compressor governor is arranged in such a way that the motor stops as soon as the pressure attains 90 pounds, and is put in operation automatically when the pressure falls below 75 pounds. The air compressor supplies air, not only for the brakes, but also for the unit switches and reverser.

The circuit which controls the movement of the reverser is a low-tension one, and is taken from a tap in the auto-transformer at the point I, which corresponds to a tension of about 40 volts. The master controller has two handles, one for controlling the speed, the other for the reverser. With the movement of the first, the low-tension magnet circuits are completed, thus closing electro-pneumatically two switches of the switch group, corresponding to the different positions on the master controller itself.

When, for example, the switch group is closed at contact 1, the motor circuit is closed between the earth and point G, which corresponds to a potential of 120 volts. Similarly, when the controller is in the positions 2, 3, 4, 5, 6, of the switch group, the motors are fed between earth and one of the points F, E, D, C, B, and they operate under 150, 180, 210, 240, 270 volts respectively. It is thus possible to obtain, without any rheostatic loss, different speeds simply by varying the number of turns of the auto-transformer windings.

During the passage from one notch to the next, in order to avoid short-circuiting the transformer tappings, the connection between the switches and the motors is made through a preventive coil, one end of which is connected successively to switches 1, 3, and 5, and the other to switches 2, 4, and 6. The centre of its winding is connected to the motors through the reverser.

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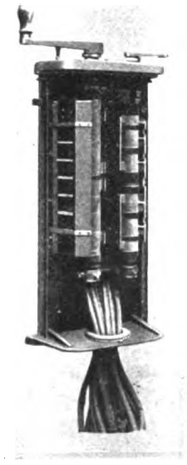


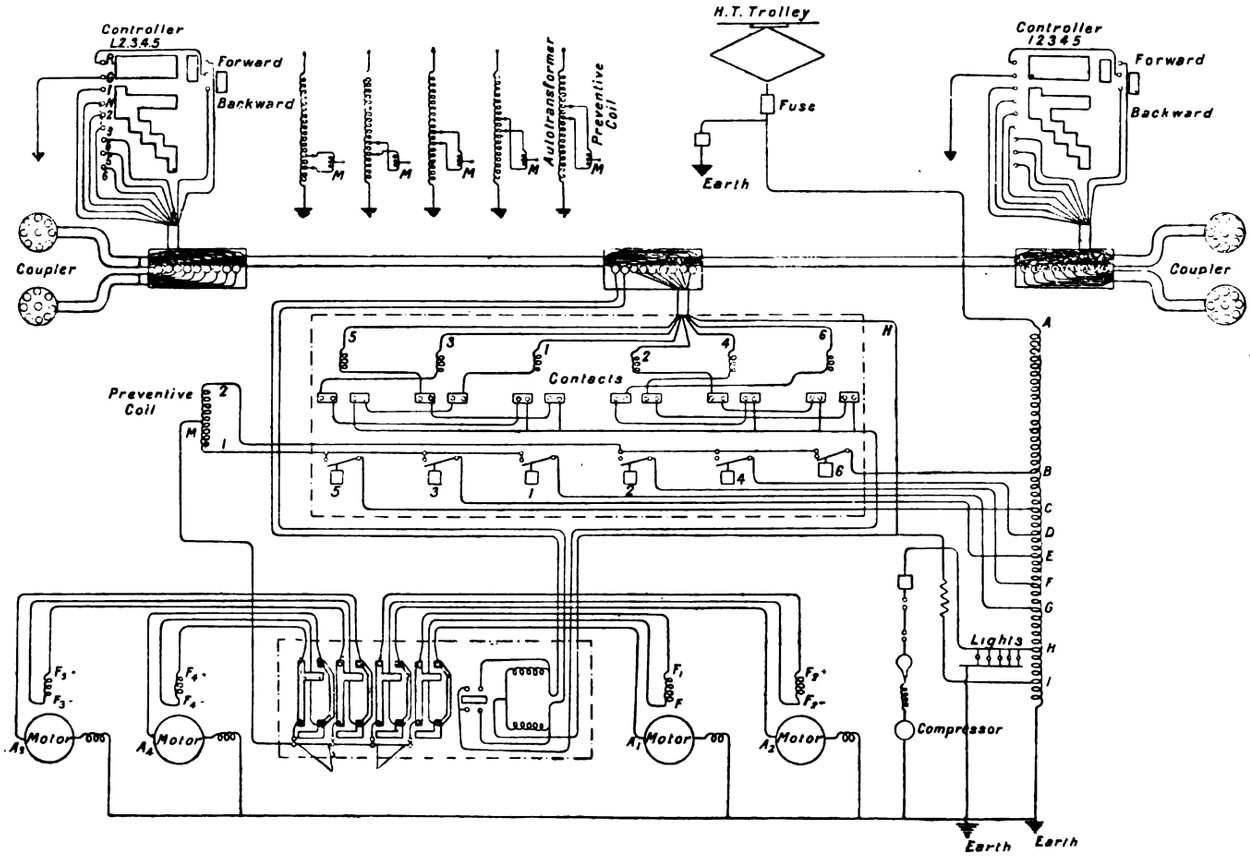
The Controller.

With the movement of the second handle the low-tension circuit energises the electro-magnets of the valves of the reverser connecting the motors for running forward or backward. All the operations for change of speed or the direction of movement are obtained from the master controller by means of a low-tension circuit. Each car has two master controllers, one on each platform. The reverser is provided with a special device which permits any motor to be cut out of circuit.

To permit the composition of goods trains of a weight greater than that allowed for one locomotive, each locomotive is provided with a coupler which permits the controlling, from one point, of two or more locomotives coupled together or with trailers. The arrangement of this coupler is similar to that used for direct-current. The low-tension circuits which actuate the switch group and the reverser form one cable, and are connected to two connecting boxes. From these boxes the conductors pass to the master controller, but they are also joined to two fixed couplers placed at each end of the locomotive. By connecting the couplers of two locomotives, the operation of the second locomotive is controlled by the master controller in the first locomotive. It is thus possible to operate simultaneously as many locomotives as desired.

As we have already seen, the distribution of current along the line is not made at the same potential; there is a low-tension section between Rome and Tor di Quinto, near Ponte Milvio, and a high-tension section between the latter town and Civita Castellana. It is, therefore, evident that if the auto-transformer is constructed to give a secondary variable voltage from 120 to 250 volts when the primary tension is 6,000 volts, the secondary tension will be much lower when the primary tension is 550 volts.

There is, therefore, on each locomotive a special device for this change The auto-transformer is provided with two in-coming leads for the current, one at the beginning of the transformer winding as represented on the diagram, the other goes directly from the trolley to a point of the transformer between A and B. Through the first is admitted the high-tension current, and through the second is admitted the low-tension current at 550 volts.



Electrical Connections of Single-phase Locomotive with Four-Motor Equipment.

When, therefore, the locomotives pass from the high to the low-tension section, and *vice versa*, it is only necessary to transfer the entrance of the current from point A to the new point (or *vice versa*). To avoid any neglect on the part

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of the driver, this change is not made at the controller, but is obtained automatically in the following way. Upon the roof of the locomotive near the side is placed a V-shaped iron arm attached to a double-throw switch—as shown in an accompanying illustration—which connects the auto-transformer windings for the tension of the trolley wire. The rotation of the V-shaped arm is obtained very easily by means of an iron rod placed horizontally on the pole where the change occurs from the high-tension to the neutral wire (and *vice versa* from the low-tension to the neutral wire), and it stands out enough to come in contact with the V iron. When the locomotive, coming from the high-tension side, passes the pole, the V iron strikes the horizontal rod obliging the former to rotate, and thus to transfer the current to the low-tension tap of the transformer.

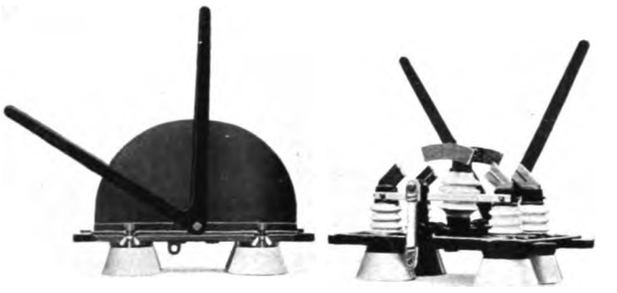
These locomotives are used to haul:

(1) Goods trains weighing 75 tons (locomotive, 20; trailers, 55). With these trains the speed, under normal voltage, can vary from 26 miles per hour on the level, to about 9 miles per hour on grades of 4·5 per cent; while, with reduced voltage, the speed varies from 15 to 6 miles per hour. At normal speed the power supplied by the central station is from 80 to 160 KW., and 81 to 140 KW. at reduced speed.

The characteristics of one train of 75 tons show that during acceleration the locomotive will take about 45 amperes during 45 seconds. This current then diminishes rapidly until it attains 16 amperes in about 3 minutes.

The speed during acceleration increases rapidly at first, attaining 5·5 miles per hour. Then it increases more slowly up to the normal speed of 28 miles per hour on the level.

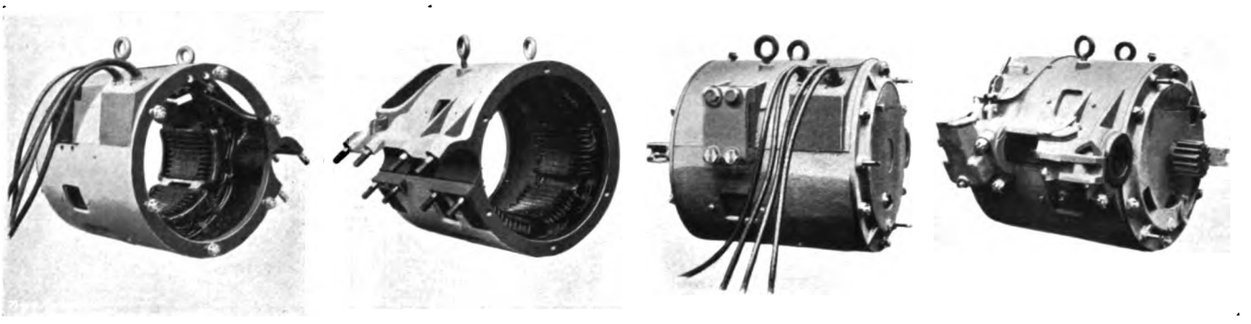
(2) Passenger trains of 50 tons (locomotive, 20; trailers, 30) attain a speed of 28 miles per hour on level, 19 miles on grades of 1 per cent., 15·5 miles on grades of 2 per cent., and 11·16 on grades of 4 per cent.



Double-Throw Switch for Trolley Circuit (6,000 – 600 volts) on Locomotive.

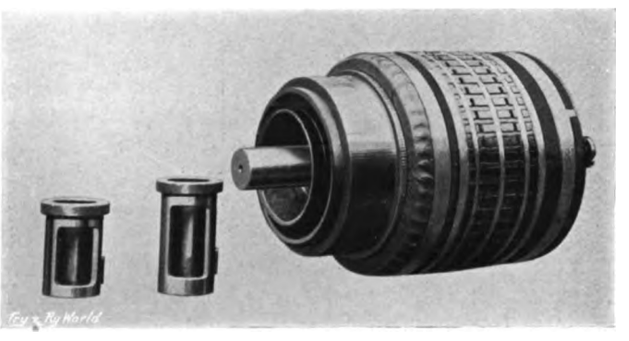
MOTOR CARS.

The motor cars weigh 12 tons, and are carried on single trucks with four 25·5 in. wheels.

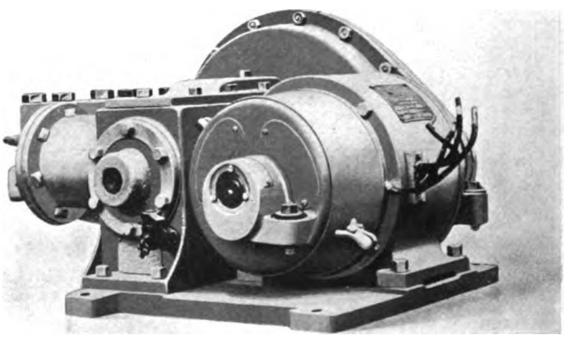


Views of 40 h.p. Motor.

The body has a length of 21 ft., and forms a closed car, with three divisions. The central one, four metres in length, is for seating passengers. The seats are placed transversely on each side of the car, one row of which consists of seats for two passengers and the other for one passenger, separated by a gangway of 20 in. The height is 6·9 ft., and the roof is arched. The width of the car body is 7 ft.



Motor Armature and Bearings.



Air Compressor.

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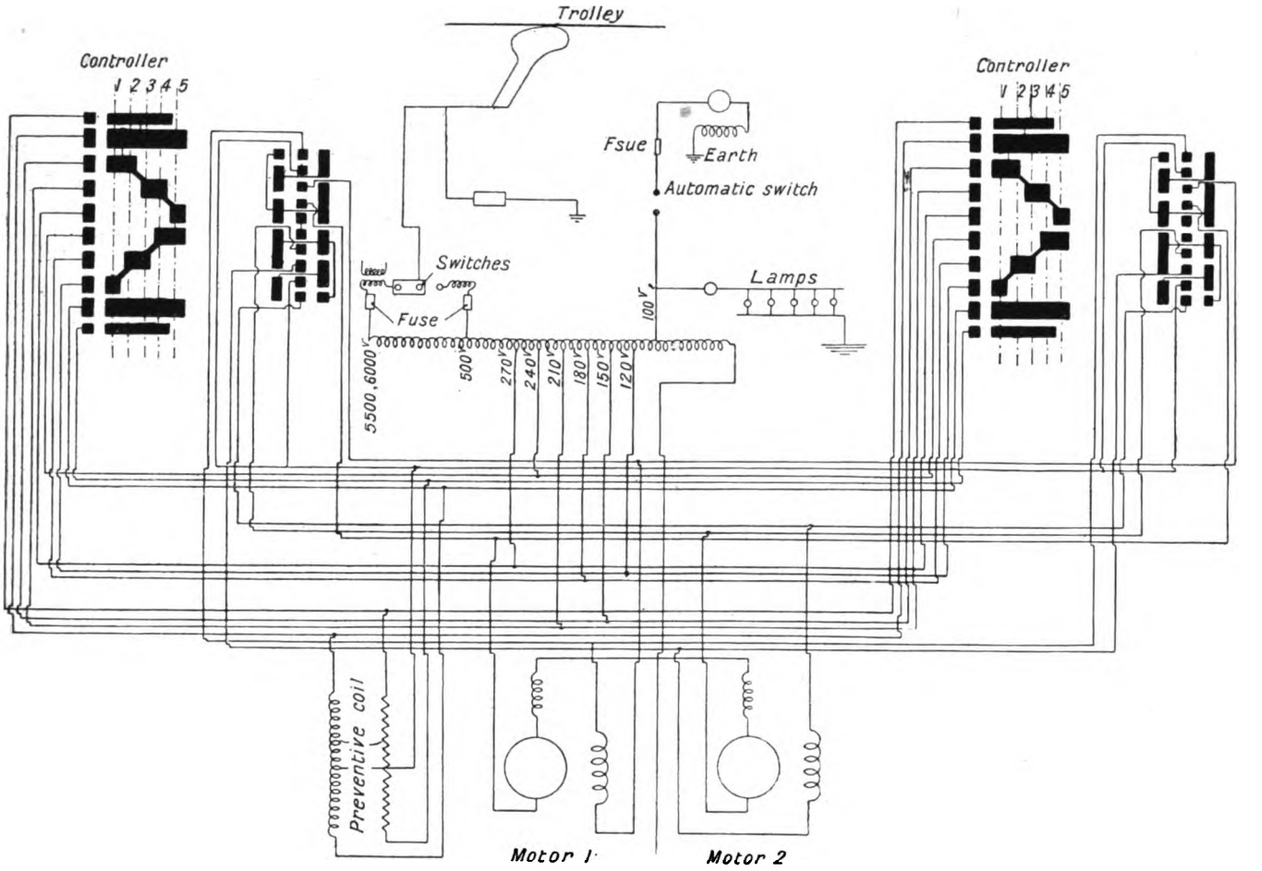
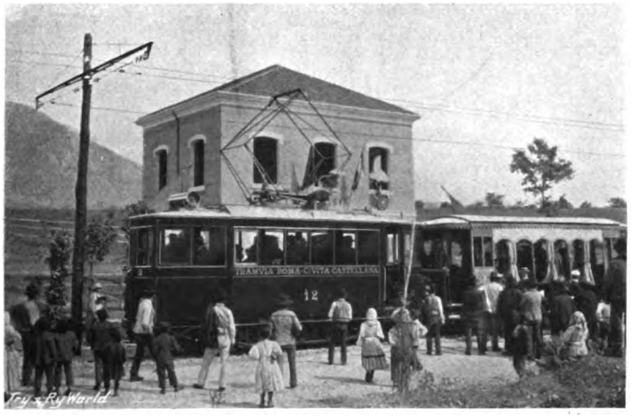
The two ends of the car are utilised by the driver and standing passengers. The cars are painted dark green externally, and the interiors are varnished. All the motor cars are second class, and the seats are of varnished wood.



Electrical Connections of a Single phase Motor Car.

The electrical equipment of each car consists of two single-phase Westinghouse motors of 40 H.P., 250 volts, 25 periods.

A diagram of the electrical connections of a single-phase motor car is given above. Their



Train at S. Oreste's Station.

operation, though somewhat different from the locomotive, is, however, more simple, owing to the fact that contacts are made at the controllers, without the use of compressed air.

The current received by the pantagraph trolley passes first through a fuse, and thence through the transformer windings and goes to earth. On the auto-transformer windings seven taps are brought out, one at 100 volts supplying the lighting circuit of five lamps in parallel, and the small motor of the air compressor similar to that on the locomotive. The other taps at 120, 150, 180, 210, 240, and 270 volts respectively, regulate the speed. Both motors have one of their terminals grounded, and work always in parallel. Each car is provided with two controllers, one on each platform, and they have two series of contacts: one for the regulation of speed, and the other for the reverser.

The complete installation of the Rome-Civita Castellana Railway, except in the power-house, was carried out under contract by the Societe Anonyme Westinghouse, of Paris, Havre, and London, to whom we are indebted for the particulars given above.

Canadian Electric Railways. According to the report of the Canadian Controller of Railway Statistics, the total length of electric railways in Canada now amounts to 814 miles. The proportion of operating expenses to gross earnings in 1907 was 61·25.

The Tramways and Light Railways Association.—The Official Circular for February contains a revised list of members. There has been a considerable accession to the membership since January 1, the list now comprising 274 individual members, and 77 companies. Among other matters, the judgment delivered by Mr. Justice Bray in the case of the Attorney-General *v.* the Yorkshire (Woollen District) Electric Tramways, Limited, holding that cars used solely on light railways are not liable to carriage or hackney carriage duty, is given in full, in view of the expiration of the period allowed for appeal. The decision is of great importance to owners of tramways and light railways, and this reprint of the judgment affords convenient access to it.

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THE GRIFFITHS-BEDELL SURFACE-CONTACT SYSTEM IN LONDON.

The G.B. surface-contact system will shortly come into service on a tramway route in London, carrying an amount of traffic such as no surface-contact system has ever dealt with before. If it proves in all respects satisfactory on the line from Aldgate to Bow, one of the main arteries of traffic through the east end of London, its reliability should be established beyond all uncertainty throughout the tramway world.

The G.B. surface-contact system is the joint invention of Mr. William Griffiths, a well-known tramway contractor, and Mr. B. H. Bedell, electrical engineer, and it is now handled by the G.B. Surface-Contact Company, of Hamilton House, Bishopsgate Street Without, London. Differing in many respects from other surface-contact methods, it attracted a good deal of attention from the first. In the latter part of 1903 a short length of demonstration and experimental track was laid down in Ilford, and it worked well and earned some good opinions from qualified judges. In 1905 the Corporation of Lincoln, desirous of avoiding the use of the trolley system, determined to instal the G.B. equipment on the tramways they were about to construct, and in November of the same year the tramways were opened. These were the first, and until now the only, tramways in regular operation using the G.B. system. The experience of over two years has shown that under the conditions at Lincoln, at all events, the system has worked satisfactorily.

The Lincoln installation was described and illustrated in this journal of January 11, 1906. The line extends over 1·75 miles of route, the length of single track being three miles. Eight cars fitted with Brush radial trucks are employed, and some of them have roof covers. They are larger and heavier than ordinary four-wheeled cars, the weight, without roof cover, but including G.B. equipment, being nine tons. Although there are practically no gradients or curves, the fact that the current consumption per car mile during the period of operation works out at the low figure of 1·19 units shows that the system is quite equal to the overhead wire method so far as economy of power is concerned. Recently this figure has been improved upon, and the consumption at present is only about one unit per car mile. When the working began, the line leakage was half an ampere at 500 volts for the three miles of track. It is now said to be ·2 of an ampere, and to be coming down. This is attributed to the insulators of the conductor cable in the tube being cleaned more and more by the alternate condensation and evaporation of moisture on them. The leakage, it may be noted, is now less than that on the conduit system of the London tramways. As to safety, we are informed that during the whole time of operation in Lincoln not a single animal has been killed by contact with a stud, no person has reported shock, and no live stud uncovered by a car has been detected.

The London County Council have within recent years seen more and more clearly that owing to the heavy cost of the conduit system it is impracticable to use it for all routes. Arising from the complication of underground pipes at certain places, the cost of conduit construction in some instances became alarming. On July 16 last year the Highways Committee presented to the Council a report recognising these facts, and urging the necessity for a cheaper system where practicable. They pointed out the difficulty of the veto of the Borough Councils against the use of the trolley wire system. As to the Aldgate to Bow tramways, arrangements had been made for electrifying a length of three-quarters of a mile on the overhead wire method, this part being in Poplar, whose Borough Council had consented to the trolley wire. The remaining 2¼ miles is in Stepney, and the Council of that borough steadily refused consent to the overhead wires. In addition to that, the conduit system could only be constructed along this route with much difficulty and at great cost on account of the shallow depth of cover between the roof of the Whitechapel and Bow Railway and the surface of the street.

The Committee had accordingly spent some time in investigating several surface-contact systems, and they were of opinion that satisfactory results were secured from the G.B. system. It was also pointed out that the same cars could be fitted also with ploughs for the conduit lines and trolley poles for overhead wire lines, so as to secure through running. Comparative figures of cost of track construction, excluding cables, were given per mile of single track, as follows: Conduit, £17,000; G.B., £10,500; overhead, £9,500.

In settling that the G. B. system should be installed on the Aldgate to Bow route, the Committee agreed with the G. B. Surface-Contact Company that the Council will pay a royalty at the rate of £500 per mile of single track up to a total of 30 miles (including the Aldgate-Bow line) and diminishing rates of royalty for any further extensions. The Council have the option of retaining or rejecting the system at the end of one year.

These proposals were approved and a contract was entered into with Messrs. Dick, Kerr and Company for reconstructing the whole line (hitherto worked by horses) at the price of £48,618. Additional items are £3,000 for royalties, £11,000 for rails, and £3,000 for special track work, making a total for the three miles of route (six miles of track) of £66,000. Cables and cable ducts were estimated to cost £13,850,

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and the fitting of surface-contact equipment to 48 cars already on order would cost £3,360. This produces a total of over £83,000, and does not include sub-stations which are already in existence, nor the price of the cars themselves. The contract for rails was given to Bolckow, Vaughan and Company, for special trackwork to Hadfield's Steel Foundry Company, for cables to the Western Electric Company, for cable ducts to J. A. Ewart, and for fitting the cars with surface-contact appliances to the G. B. Surface-Contact Company. That company have also provided all the surface-contact apparatus required in the street, Messrs. Dick, Kerr and Company laying it down under their supervision at the same time as the rest of the trackwork.

The Earthenware Pipe for the Conductor Under Construction.

G.B. Track Ready for Paving.

The decision of the County Council, in terms of the above, was reached on July 23 last, but owing to delay on the part of the Board of Trade in approving the plans actual work on the streets was not commenced till October 20 last. The contract with the G. B. Company for car equipment was only finally settled on December 24, so that though the street work is now practically complete, it will be some little time yet before the cars are ready for running. The street work has been carried out with great expedition, as the horse-car service was stopped and reconstruction of both tracks was carried on simultaneously.

G.B. Track Completed—Adjusting Studs.

The route does not present any special features, being a straight-away road, practically level, and with no sharp curves. The surface-contact line begins at Commercial Road, the remaining 150 yards or so of the tracks to Aldgate being on the conduit system. A complicated conduit junction occurs at Commercial Road, several conduit lines diverging at this point. This junction was installed about a year ago. Whether the surface-contact cars will run over the piece of conduit line to Aldgate, or will be turned at Commercial Road, remains to be seen. Arrangements have, however, been made to allow of through running. A pit is provided under the tracks at the junction of the two systems in which a man can slide the plough off or on its carrier as required. The Bournemouth method of winding up the plough through a

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hatch in the street has not been adopted, as the London plough and plough carrier are of a very heavy and substantial type.

The system as installed in London differs in some particulars from that in Lincoln, and these points will be indicated in the general description which follows. In the G. B. system the working conductor consists of a steel wire cable $1\frac{3}{16}$ in. in diameter, carried on insulators in an earthenware pipe. This pipe is laid under the centre of the track, and the current passes to the cars through studs placed at short intervals in the street surface. The connection between the studs and the cable is effected magnetically at the moment the car magnet comes over them, and ceases immediately it leaves them. The 500-volt feeder cables from the County Council's sub-stations run under the sides of the streets in the usual way, and are tapped at intervals into the working conductor, which is divided into half-mile sections. The arrangement of feeding is somewhat similar to that employed on the Council's slotted conduit lines, and it may be easily gathered from the section, Fig. 1.

Figs. 2 and 3 show both in longitudinal and cross sections the arrangements of the pipe, the working conductor, and the studs. In Lincoln the glazed vitrified stoneware pipe is circular in section, and 5 in. in diameter. In London the tube is egg-shaped, and measures 5 in. horizontally by 6 in. vertically. The conduit is completely bedded in concrete, and its lengths are united by a bituminous joint. The total depth of the trench for the construction is about 20 in., measured from the top of the paving setts, and the depth of the underside of the tube from the rail level is 17 in.

The insulators which carry the working conductor are of vitrified glazed earthenware of the spool section shown in the drawings. They are mounted on galvanised steel pins which pass through the conduit on one side, through the hole in the centre of the insulator, and into a stopped hole on the opposite side of the conduit. Those ends of the pins or axles which project through the conduit are connected together by means of a galvanised iron strip running the entire length of the track, which is connected at intervals to the rails. This strip may be seen in the illustrations showing the track under construction. The arrangement described is a most valuable one, as experience at Lincoln has shown that it has solved the difficulty of slight undiscoverable leakages of current over the surface

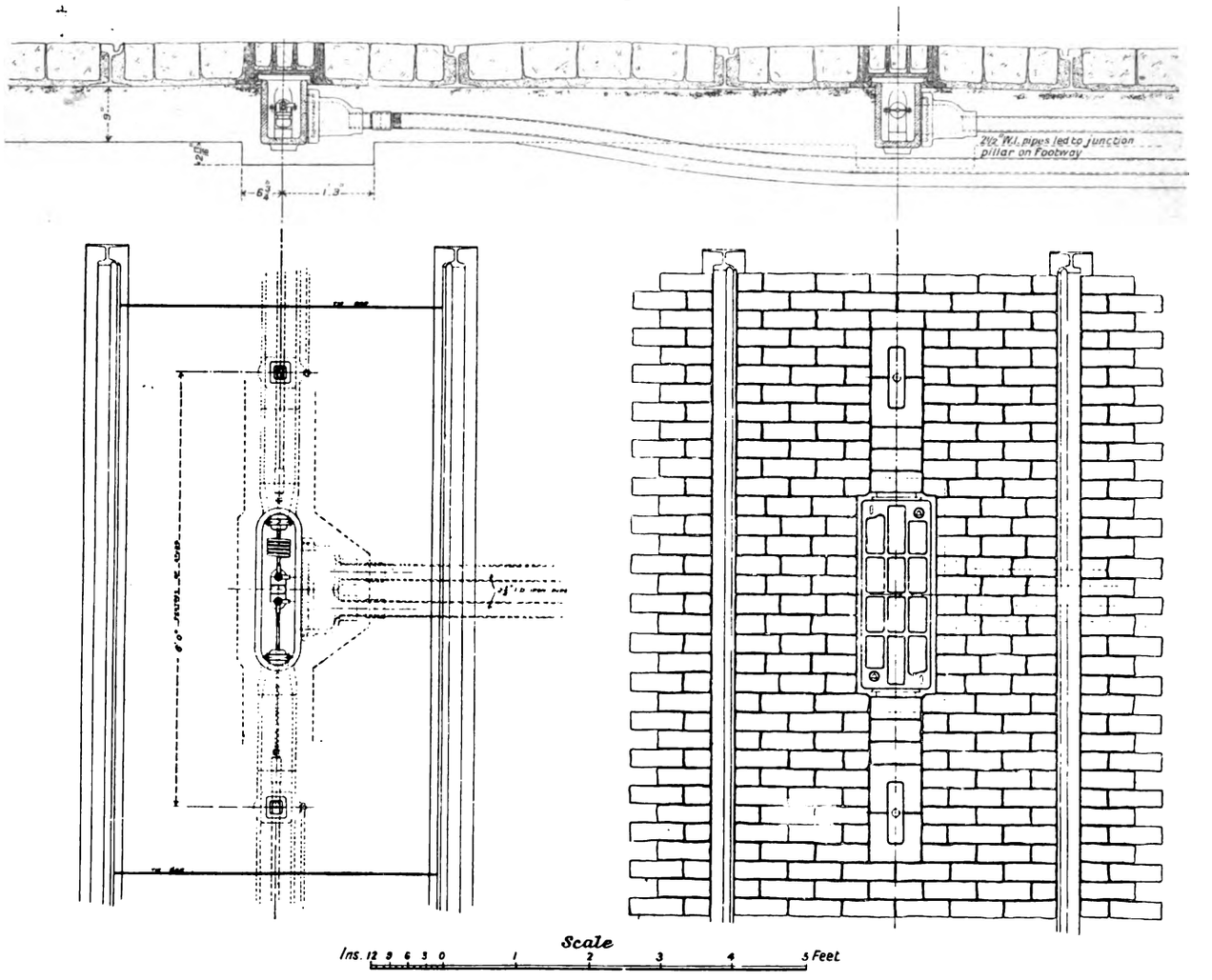

Fig. 1.—Section and Plans Showing Arrangement of Section Insulator, Feeder Ducts, and Studs.

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of the insulator and up the sides of the box to the contact stud on the street surface. Such small leakages, if they were to occur, cannot be found by the live-stud-detector on the car, and may give rise to trouble. With this earthing device no trouble of the kind has been experienced.

Access boxes (Figs. 3 to 5) are placed at intervals of 200 to 400 yards along the track. Each box consists of a cast-iron body and manganese steel cover, which is paved in like the rest of the street. These boxes are used for drawing in and withdrawing the cable, and the insulators act as rollers to help the process. Two sections of conduit enter each box on opposite sides, and the two cable ends are led to terminal bars mounted on insulators fixed to the box. Drainage connections are provided from the bottoms of those access boxes which are situated at the lowest points of the track. From Aldgate to Bow there are about 20 of these connections, which are shown sectionally in Figs. 4 and 5. The drainage pipes lead into sumps at the side of the track, but it is unnecessary to connect the sumps to the sewers as very little water gets in. The sumps are pumped out occasionally as required.

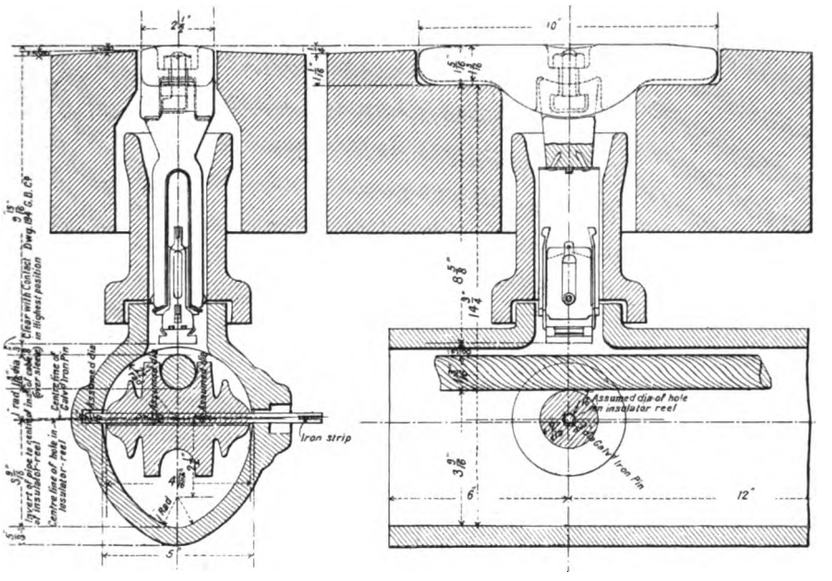

Fig. 2.—Cross and Longitudinal Sections of Conduit and Stud.

The steel wire working conductor, as originally installed in Lincoln, was bare. Though made on the Lang lay its surface is not smooth, and it was found that the contact for electrical purposes between the moving contact piece of the stud and the cable was not always good enough. The cable has since been encased in a loose galvanised iron tube, divided into 6 in. lengths. This makes thorough contact inside with the cable, while outside it presents a smooth surface for the moving contact piece. By using the tubing in such short lengths the flexibility of the cable for the purpose of drawing in and of removing is unimpaired. This cable covering is used throughout in the London installation.

The studs, shown in Figs. 2 and 3, have cast-iron heads, the top surfaces of which are level with the surface of the street paving. They are spaced 6 ft. apart, instead of 9 ft. as in the case of Lincoln. The reason for the shorter spacing is that the London County Council are keeping the plough carriers (required for the ordinary conduit working) on the cars which will run over the G. B. lines, with the result that the available length underneath the car for the surface-contact collector is only half the car length. The space between the centre of the car and one of the motors is largely taken up by the plough carrier.

The studs are supported on granite blocks recessed to receive them. The head measures 10 in. by 2½ in. The vertical part of the stud, which projects downward into the upright piece of pipe communicating with the tube below, is forked at the lower end and lined with brass. Within the fork is mounted the only moving part in connection with the electrical equipment of the track. This consists of a piece of galvanised iron, suspended freely, by means of an insulated steel coil spring heavily coated with copper, from the top of the fork. Its movement is limited by a brass pin, which passes through a slot, and is riveted into the jaws of the fork. At the lower end of the moving piece a carbon contact block in a copper clip is attached. Flexible copper leads connect the copper clip with the main portion of the stud. When the magnet carried by the car passes over the stud, the moving piece is magnetically attracted towards the working conductor against the pull of the spring, so that the carbon block is in contact with the cable, and current passes from the cable through the carbon and the flexible copper connections to the stud head, where it is collected by the car. As soon as the car has passed, and the stud has ceased to be under the influence of the magnet carried by it, the pull of the spring withdraws the moving part from contact with the cable, and the stud is left dead. The durability of the spring is ensured because the maximum possible extension is well within the elastic limit, and the spring is not subjected to jars. Experiments have shown that after being subjected to the same number of extensions as would occur in the life of a stud on a tramway with a two-minute service during a period of over 20 years, no alteration in the elasticity of the springs is discernable.

The surface-contact equipment for the cars is shown in Figs. 6 and 7. It consists of a magnet, a current collector, a small storage battery, and the necessary wiring connections. The magnet

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is suspended rigidly from the car. The magnet coils and the battery are connected so that when the motors are taking current their current, when small, assists the battery in exciting the magnet, and when large it also recharges the battery. Special arrangements for charging the battery are thus unnecessary. The magnet poles facing the street surface are all north poles, and the magnetic circuit is completed through the ground and the air to the south poles above.

The current collector consists of a series of iron links, spring suspended under the magnet poles. This flexible collector takes the place of the iron or steel skate used in other systems where the studs project a little above the paving. The links are each 5 in. long and are threaded on steel wire fixed with set screws and fastened with eye-bolts. The links at the ends of the chain are loosely connected to the polar extensions of the magnet. When the pole of the magnet passes over a stud head, the magnetic attraction causes the links to move down and make contact with it. As each link reaches the end of a stud it is drawn up out of contact with the road by the spring suspension. The magnet pole piece is about 2 in. above the road level, and so is clear of small obstructions. The current collectors on the Lincoln cars wear for 18,000 to 20,000 car miles.

Although no live studs due to leakage have been found in practice, each car is fitted with detectors as a safeguard. These consist of short auxiliary current collectors at each end of the car. Should a stud by any fault in the mechanism be left alive after the main collector leaves it, the current from the stud passes through the detector

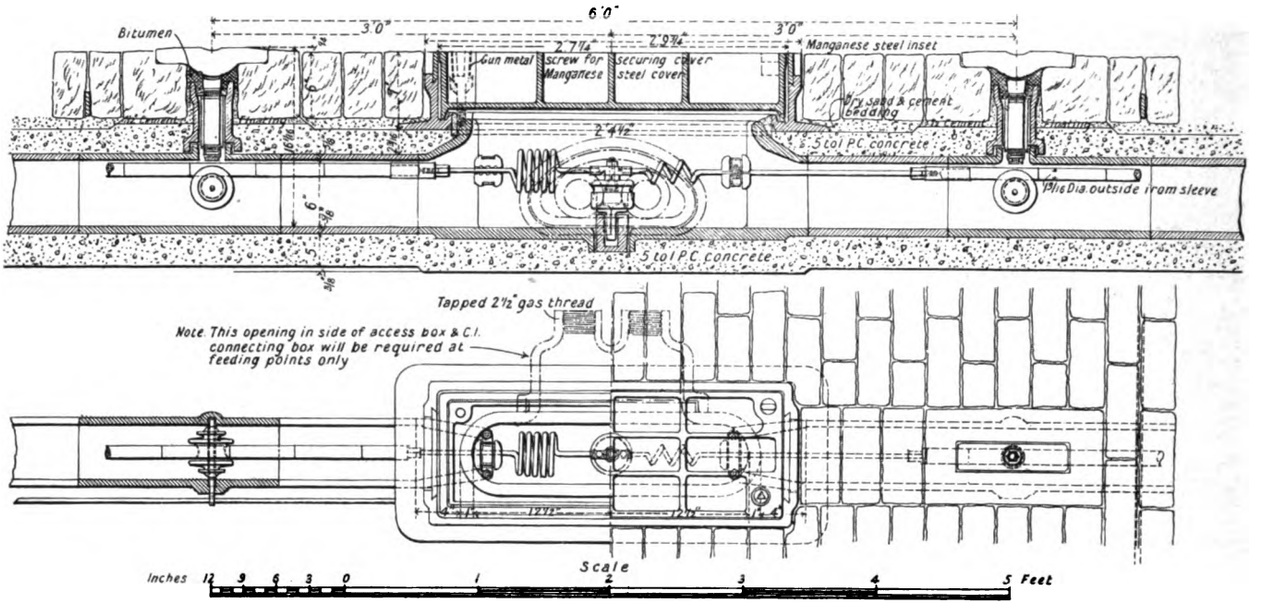

Fig. 3.—Longitudinal Section and Plan of Conduit at Section Insulator.

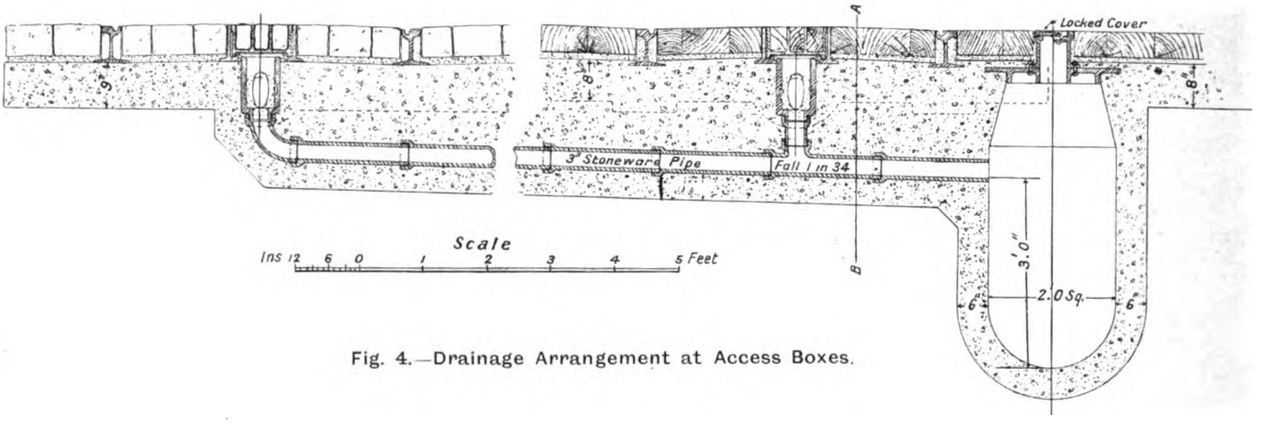

Fig. 4.—Drainage Arrangement at Access Boxes.

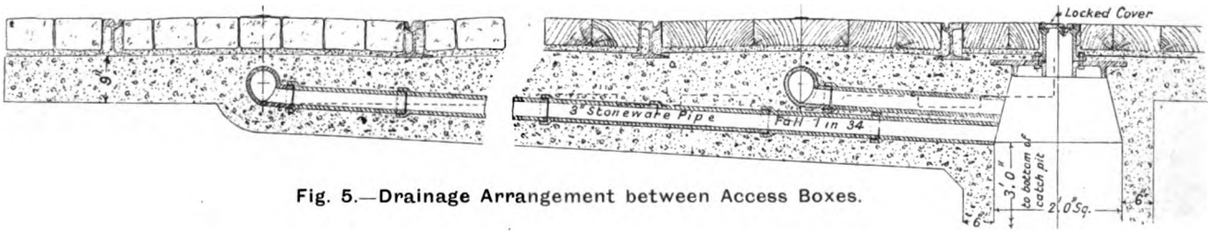

Fig. 5.—Drainage Arrangement between Access Boxes.

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and opens a circuit breaker in the main motor circuit, thus stopping the car. A warning mark is set up at the live stud, and this is shifted and replaced by the conductors of succeeding cars till workmen can put the stud right again. Thus the service can be carried on in the interim. Though this safeguard is provided, it has not so far been required in Lincoln.

The energy used to excite the collector magnet is 11 amperes at 18 volts, working out, for an average car speed of eight miles an hour, at ·0247 unit per car mile.

The permanent way is constructed exactly

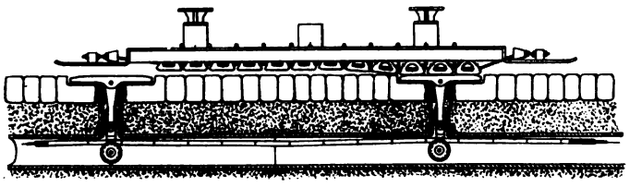

Fig. 6.—Section Showing Magnet and Collector.

according to the standard practice of the London County Council, apart from the conduit part of the construction. The rails are of British standard section No. 4, weighing 105 lb. per yard. The joints have the usual sole-plates, which also serve as anchors, and intermediate anchors are put down at intervals of 7 ft. 6 in. The bed of concrete follows the Council's practice, being 9 in. thick, against 6 in. used in most other towns. The only departure from the type of track described in previous articles consists (apart from the conduit) in the insertion of a ⅝ in. teak packing between the rail joints and the

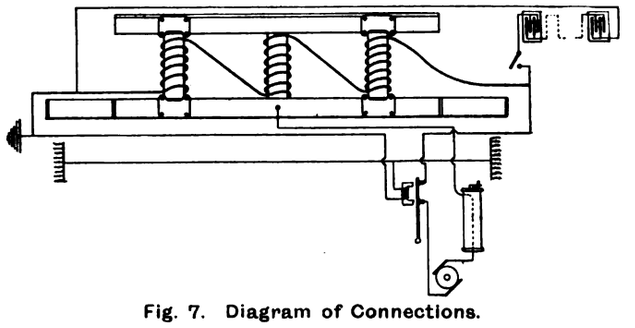

Fig. 7. Diagram of Connections.

sole-plates. The same packing is used at the intermediate anchors. The change has been made on the suggestion of Mr. A. L. C. Fell, the chief officer of tramways, the idea being to provide a little elasticity and deaden noise.

The plant and equipment provided will enable cars to run on a minute-and-a-half headway, or even less if desired. As previously indicated, this will put the system to a test such as no surface-contact system has had before.

It should be mentioned that the original intention was to have through running from Aldgate on to the West Ham Corporation tramways, as there is a physical junction between the two systems at the London boundary at Bow. So far, however, the West Ham Corporation have not seen their way to equip any of their cars with the surface-contact collecting equipment, and the County Council in their turn are not equipping the surface-contact cars with trolley poles to enable them to run on the West Ham lines. Through passengers will thus have to change cars at the boundary.

The whole of the work has been carried out to the designs of Mr. M. Fitzmaurice, chief engineer to the London County Council, in co-operation with Mr. Fell, the chief officer, and Mr. John Rider, tramway electrical engineer to the Council.

BOARD OF TRADE TRAMWAY RETURNS.

The Board of Trade return of tramways and light railways in the United Kingdom for 1906-7 was issued early in February. The figures deal with the undertakings of companies for the calendar year 1906, and with those of municipalities for the financial year ended March 31, 1907. The prefatory memorandum points out that since 1878 the route length of line open for traffic has increased from 270 miles to 2,400 miles; the capital expenditure from £4,207,400 to £64,092,100; the number of passengers carried from 146 millions to 2,455 millions; and the net receipts from £231,000 to £4,485,400. Of the total of 1,570 miles of line owned by local authorities, 1,420 miles are worked by those authorities themselves, and the remaining 150 miles by leasing companies. Last year the route mileage open of electric line was 1,990 miles, out of a total of 2,240; this year it is 2,190 miles out of 2,390. The mileage worked otherwise than by electric traction has further diminished from 250 miles to almost 200 miles, of which 64½ miles are worked by steam, 25½ miles by cable, 4 miles by gas motors, and 105 miles by horses. The net increase since last year in the number of undertakings belonging to local authorities (179 out of 318) is four, and in the number belonging to other parties (139 out of 318) is two. Local authorities who work, as well as own, their tramway undertakings, have made a net profit of £2,985,300 on the year's traffic, out of which they have applied £963,100 towards the reduction of tramway debt and £297,500 in relief of rates, while carrying £691,600 to reserve and renewal funds. In the cases of three local authorities and four companies there was an excess of working expenditure over gross receipts.

The following table gives a few totals, ratios, and percentages for the last two years, in comparison with a typical "steam" period (*i.e.*, a period in which the use of steam power on tramways was at its maximum) and a typical "horse" period:

	1906-7.	1905-6.	1898.	1879.
	Electric period.		Steam period.	Horse period.
Length of route open ...	2,394·30 miles.	2,239·99 miles.	1,064·19 miles.	321·27 miles.
Total passengers carried...	2,454,807,487	2,236,012,777	858,485,542	150,881,515
Capital expenditure per mile of single track:				
Lines and works ...	£12,362	£12,122	£7,770	£7,840
All items ...	£16,648	£16,195	£10,469	£9,877
Percentage of net receipts to capital outlay... ...	6·99	6·54	6·38	3·97
Do. to net capital outlay (eliminating amounts expended on construction or purchase of old lines and works now superseded) ...	7·48	7·05	Not available	
Percentage of working expenditure to gross rec'pts	62·14	64·23	76·93	83·81
Passengers per mile of route open	1,025,271	998,226	806,703	469,641
Passengers per car mile ...	9·22	9·16	9·48	7·77
Average receipt per passenger	1·10d.	1·10d.	1·23d.	1·84d.
Amount paid in relief of rates out of profits by local authorities	£297,456	£205,981	(Not given)	(Not applicable)

The total expenditure on capital account by companies is £22,356,500, and by local authorities £41,735,500, and the net revenue earned by companies represents 6½ per cent. on this outlay, and by municipalities 7¼ per cent. The amount actually distributed by companies in interest and dividends was equal to about 3½ per cent. on the total paid-up capital.

Power for Railways from Niagara.—According to a press telegram from Montreal, the Grand Trunk Railway Company are negotiating for the control of the Niagara electric development plant. The company desire, it is reported, to electrify their eastern division, which includes a very large mileage of railways.

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THE

Tramway and Railway World

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We shall be pleased to receive at all times articles, papers, notes, and correspondence on subjects of interest to those concerned in the financial administration, construction, or management of tramway and light railway undertakings. Particulars as to the issue of specifications, the progress and completion of contracts for new work, and suggestions for improvements in all branches of tramway enterprise will receive special attention.

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Surface Contact Traction.

The details published in this issue in regard to an installation of a surface-contact system of traction in London, while of interest to all tramway men, will specially appeal to those who, in past years and down to the present time, have closely watched what may be called the battle of the systems. In principle the mechanism about to come into service in the metropolis is not new, as the same system has been in successful operation in Lincoln for over two years, but it has been modified in various details. It is also important as marking the first occasion on which a surface-contact system is called upon to deal with a heavy city traffic. In regard to systems of electric traction, it is well known that for years the London County Council have been "between the devil and the deep sea." On the one side the heavy capital cost of the slotted conduit system is continually mounting up as new lines are constructed, while on the other the Council have, in nearly every case where an attempt was made to escape, been barred by the veto of the borough councils from the use of overhead wires. It was an evil day for tramway development in London when there was inserted in the Act, giving the County Council general powers of tramway electrification, the clause which prohibited them from using the trolley system except with the consent of the borough council or councils concerned. The policy of the attitude of the borough councils has been of the most short-sighted kind, especially when it is considered that they represent the same ratepayers as return to office the members of the County Council. The wonder is that the latter body did not long ago begin experimenting with surface-contact systems, which cost very little more to instal than the overhead wire method. For the sake of all concerned it is to be hoped that the present departure will prove as great a success as is anticipated by those responsible for it.

London Development.

Another interesting event in connection with the tramways of the metropolis is the grant by the County Council of a substantial increase of salary to Mr. Fell, the chief officer of tramways. That the recognition has not come too soon, and that it is thoroughly well deserved, will be admitted by all who know the circumstances and the man. Even now, it cannot be said that the remuneration is commensurate to the responsibility and the work. One has only to compare the salaries paid to the general managers in other large commercial businesses in order to come to that conclusion. It may come as a surprise to those who have not paid attention to the growth of the London tramway enterprise, that at present the traffic receipts are at the rate of about £30,000 a week, and that the number of passengers is about 1,000,000 per day. A considerable proportion of the totals comes from lines which are still being worked by horses. These are steadily being changed to the electric system, and the completion of every conversion marks another bound up in receipts and passengers. Besides that, new lines are being constructed on routes where no tramways existed before. It is quite plain that before long this great system will be carrying 400,000,000 passengers per annum. That figure would be far surpassed if tramways were allowed all over London, but a large part of the central and western districts presents a closed door.

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Railway and Tramway Competition.

Probably never since electric tramways began operation in this country has the outcry of railway chairmen against the competition been so keen as at the half-yearly meetings of the railway companies held during February. The loss in short-distance suburban passengers is greater than ever before, and in the case of the main line railways entering London, part of the loss is also attributed to motor omnibuses. It may now be taken as established that for distances up to three or four miles the railway must suffer heavily if there is a competing electric tramway. Various aspects of the question of electrification of suburban railways in order to meet the competition were discussed in a recent paper by Mr. Philip Dawson, submitted to the Royal Automobile Club. There can be no doubt that the adoption of electricity would enable the railway companies to regain much of their lost traffic, but what is more important, it would enable them to build up a great new traffic. By the higher speed of the electric trains, remote suburbs and outlying districts, now mostly rural, would be brought within easy distance, from the point of view of time, of the centres of cities. The great object of spreading the population out would be rapidly advanced, while at the same time local communication in these outlying districts could be provided in all directions by an inexpensive form of electric tramway or light railway. Such developments would before long lead to great benefits alike to the public, the railways, and the tramways. It cannot be doubted that these things are coming; the uncertainty as yet is how much longer the incubation period will last.

Motor Omnibus and Municipal Tramways.

Considerable excitement appears to have been stirred up in Ilford because a motor omnibus company has started running 'buses through the district, competing with the municipal tramways. Despite reduction of fares and a more frequent service, the tramways have actually suffered in receipts. Ilford, though in Essex, may be said to form part of the metropolitan area, as from the city of London eastwards to the afflicted district the roads are almost entirely urban. Through tramway running does not exist, and as the omnibuses appear to connect right into the centre of London the tramways are at a disadvantage in that respect. The completion of electrification of the East London tramways should allow of through running being inaugurated. If a case arises, however, of absolute cut-throat competition for local passengers between an electric tramway and a 'bus service, there can hardly be any question that the tramway will come out the victor. The tramway can "live" on receipts per car mile, which would be ruinous to the omnibus.

The Development of Tramways.

There are now signs that the lethargy in the development of Municipal undertakings is passing away, and already the number of advertisements by Corporations for tenders for machinery and apparatus is increasing, though, so far, such advertisements indicate that developments are likely to be mainly confined to lighting and power purposes. It is, however, heartily to be hoped that the welcome change will quickly extend to traction business also. Of course, a number of tramway undertakings exist upon which any attempt at extension, either now or for some years to come, would be a waste of money. Some of these systems have but little reason to exist at all, having been constructed in places where they never could hope to pay their way. Their only excuse for coming into being was that the muncipal idea was rampant at the time. Still, leaving these undesirables out of the question, we say that tramways which have been built and managed upon commercial lines, and without any exaggerated notions as to earning capacity, have fully justified the enterprise of their municipal owners, and it is among this class of undertakings that we hold there is room for extension at the present time. To accentuate the reasonableness of this view, we would point out that the most successful tramways are those operating in growing urban centres. In localities such as these it almost always happens that there is a concentration of industrial and commercial undertakings in the central part of the area, with the inevitable result that new suburbs and outskirts are built to meet the residential requirements of the workers. It is the suburban traffic, plus, of course, that which is purely urban, which makes for financial success. This

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type of tramway is, *par excellence*, that which offers most favourable scope for extension, and it is to be doubted whether, as they now stand, such systems are keeping pace with the needs of those who, while compelled to labour in the central area, desire to live as far removed therefrom as transit facilities and other conditions will allow.

* * *

Regarding the finance of extension works, it must be borne in mind that these are on quite a different footing from the construction of a new undertaking, and that a line which, as an independent service, could not possibly pay, may, as an extension of an existing system, barring urban termini, prove very valuable. It starts operations, in fact, with something to feed it and to feed into. While it is true that more than one large municipality are at present contemplating important additions to their existing systems, the necessity for obtaining Parliamentary sanction, and the time and expense involved, render it uncertain when the work will be commenced, and it is not those, but other important systems which we have in mind, when we say the time is ripe for development. Indeed, we cannot help thinking that a number of municipal authorities already possessing powers of extension might well use them with general benefit to the undertaking. Some of the conditions which operated against tramway development last year have now improved, inasmuch as municipal loans are not in such disfavour, and the price of copper is much more favourable. Hence it would be well that the present opportunity should be taken to infuse a little fresh life into some of the systems. It is an old axiom in business—and a true one—that no concern can, at least for long, stand still. It must either move ahead or lose ground. And this applies with the same force to a tramway as to any other undertaking. At the present time less than at any other can electric tramways afford to look back. They are always being attacked on one ground or another, and it is only by a policy of steady progress that they can hope to conquer the successful future which we believe lies before them. These remarks do not apply to those large towns where an intelligent policy with regard to tramway extension has always prevailed, but there are, we are certain, a number of large systems where extensions have been imperatively needed for some time past, but where, for some reason or other, a disinclination has been shown to move. In some cases municipal politics or some other purely local cause is probably responsible, but, whatever the cause, the fact remains that tramway extensions, of very considerable magnitude, could be carried out which would not only yield an adequate return on the capital expended, but would be of benefit to electrical manufacturers.

Street Traffic on the Continent.

It is evident that the means of easy (therefore cheap) and comfortable transportation for goods and passengers are considered of primary importance in most of the Continental countries of Europe; so much so that individual and vested interests have to give way to street and road railways and tramways wherever they form an obstacle to the free use of such means of transportation. Tramway termini are always brought as close as possible to railway stations and, wherever goods are handled on them, the light lines are physically connected with the main lines. Rails are laid along many of the main roads and run into the factories which lie dotted all over the country to such an extent that one is seldom out of sight of a smoke stack belonging to such manufactories. The villas in which the owners live are also served by the same line of rails, which indeed appears to be laid without any regard to ordinary road traffic—of which, indeed, little can be seen. Most of these interurban lines are electric overhead, though many of them are still worked by light locomotives hauling the ordinary goods stock. Even in the towns the tramways come first, while all other kinds of traffic are—more or less—subordinate. Motor 'buses are being introduced in most capitals, but it is very doubtful if they are made to pay their way, owing to the competition of the tramways and of other electric urban railways. The new motor cab is found in most Continental cities of any importance—the fares are low and the service is excellent—so much so that in hilly cities like Brussels or Stuttgart it is difficult to imagine how people used to get about before they were introduced. The urban systems or routes of tramways are generally distinguished by large skeleton numerals or letters attached to the bow trolley

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pole and distinguishable at a great distance. Great use is made of transfer tickets, and a little study of the system will enable even a newcomer to get about without having to ask his way, and at a very cheap rate indeed. As Continental towns are insignificant in size compared with our huge and overgrown metropolis, it is proportionately easier to learn how to travel to the best advantage. As to the interurban lines, it cannot be said that the service is very rapid, indeed, it is quite the reverse, and one cannot easily go wrong, for there is plenty of time to discuss matters with the conductor, who is always willing and indeed anxious to help a stranger and prevent him from going astray. There are mostly two classes in even the smallest cars, and smokers have to stand on the platforms. The drivers are generally protected from the weather and, in some cases, have a portable glass wind-screen, which they carry with them from one end of the car to the other. Altogether it may be said that the question of facilitating transportation with the help of rails is tackled in a leisurely, matter-of-fact, common-sense way which Britishers used to pride themselves was one of their most distinguished attributes—this opinion, however, a little wandering about in the highways and by-ways of Continental countries might considerably modify.

CORRESPONDENCE.

Rail Corrugations.

To the Editor of The Tramway and Railway World.

Dear Sir,—In reply to Mr. Ward's comments on the above subject as published in your last issue.

I would ask him to read again the November issue and carefully note that nothing was then said about squared-up trucks curing rail corrugations; nor on any previous occasion.

This erroneous impression has evidently been gained from the paper read before the I.E.E., and there mentioned in order to show the effect that single-ended gear-driven axles had on weak truck design.

One member went so far as to give professional advice to this effect to one of our largest corporations; the result, needless to say, is out of print.

If Mr. Ward or anyone else has seen a rail grinder in use on the overhead tramway route, between Seaforth and Crosby, within the last 18 months, I am willing to give a substantial sum towards Liverpool's new superanuation fund; and if he can find any corrugations to-day likely to cause the least bit of noise I shall be delighted to see them, as it would give me fresh ground for further study.

No doubt Mr. Ward is confusing the tramway route with the railway route, here the remedy is a much larger operation, the conditions being very severe. So far the results obtained have been satisfactory, and now show a decided improvement towards increased rail wear, the corrugating action being less severe with the same composition of rails.

Again, I did not say the District Railway Company's Sandberg rails corrugated because they were too hard.

What Mr. Ward really wants to impress is his idea of a loose wheel, as a basis he starts off with the hardy annual of rails on curves varying in length, whereas the two wheels are fast on the axle (as they ought to be, and always have been).

How then did railway companies under these same conditions get round curves, at much higher speeds without corrugations, long before tramways were ever thought of? Naturally, you will say by super-elevated rails.

How then is it to day that electric railways on the same super-elevated curves cause corrugations?

Let me tell Mr. Ward and others interested, that in dispensing with corrugations on the Seaforth and Crosby tram route, no trucks were squared up or loose wheels used. I examined the loose-wheel drawings and claims some 12 months ago, but could see nothing to warrant their existence.

However, Liverpool residents will be glad to hear that something is being tried by Mr. Ward, other than changing rails every 3 months on curves, as that cure is worse than the disease.

J. A. Panton.

Liverpool Overhead Railway.

Lifeguards.

To the Editor of the Tramway and Railway World.

Sir,—The Board of Trade, in their last issue of lifeguard regulations, specify springs must be used for holding the trays down on the road. This is already done on most, if not all, of the gate and cradle type of lifeguards now in use, and still we hear of people being killed by getting under the cradle. We fail to see how springs, however strong, will prevent this; but it will add to the injury of the victims. If the springs are strong enough and the roadways rough and uneven, the cradle will be smashed before it reaches the victim.

We use a spring, but do not depend on it for holding the tray down; our tray being flexible, it does not bounce, but lies closely to the road no matter how uneven, and it is absolutely impossible for any one, no matter in what position they fall, to get under the tray.

Our system has the full approval of the Board of Trade, and it has amply merited their approval, as it is the only system that has never failed to do all that it is possible for any system to do.

We may also say that the cost of maintenance has been proved to be almost nil.

Philipson & Co.

Bolton.

Bolton Corporation Tramways Committee have decided to give their motormen and conductors seven clear days' holiday each year, and to pay them for 60 hours. The same concession is made to the night shed men, with an allowance of 55 hours' pay.

Electric Power in Factories.—Mr. James Swinburne, F.R.S., on March 3, opened the inquiry ordered by the Home Office regarding the objections lodged to the draft regulations relating to the use of electricity in factories and other places under the Factory Act.

Metropolitan Association of Electric Tramway Managers.—The quarterly meeting of the above Association was held at the Municipal and County Club, Whitehall, S.W., on Friday, February 14, 1908, the following members being present: Messrs. H. E. Blain, West Ham; A. Coveney, Erith; T. B. Goodyer, Croydon; W. E. Hammond, Metropolitan Electric Tramways; G. R. Hulme, South Metropolitan Tramways; H. L. Howard, Barking; C. Mittelhausen, Bexley; F. Schofield, Leyton; H. Shaw, Ilford; and W. C. Ullmann, East Ham. A number of subjects of interest to managers in the Metropolitan area were discussed at the meeting.

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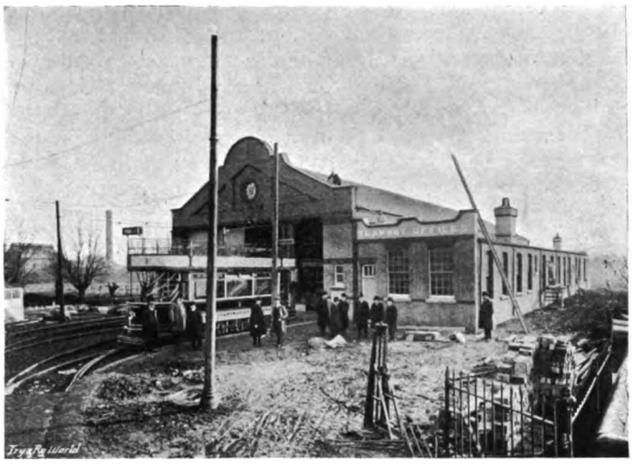
LUTON ELECTRIC TRAMWAYS.

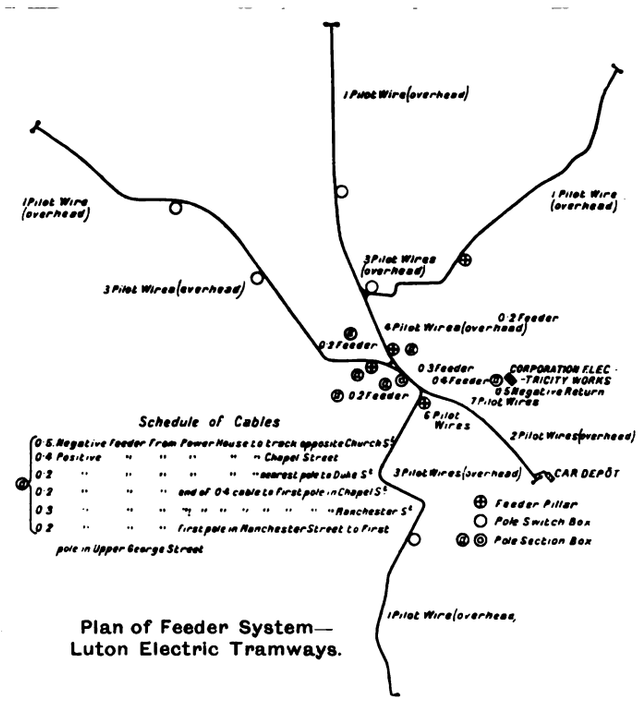
Luton, a thriving town of some 40,000 inhabitants, is the latest local authority to come into possession of a well-equipped modern tramway. While it has paid for and owns its tramway system, it has leased the undertaking to a well-known engineering company, which has assumed the risk inevitably attending the working of a tramway system in a comparatively small town. The Luton tramways were opened on February 21, but they have a history dating as far back as May, 1900, when the question of the Corporation applying for a Provisional Order was first discussed. No further step was taken, however, until October, 1901, when a tramways committee was appointed for the purpose of considering any scheme which might be submitted for providing tramways for Luton. One or two abortive schemes were introduced, but in May, 1903, the then borough engineer suggested the construction of about four miles of tramway within the borough, and it was resolved to advertise for offers from company promoters or other qualified persons who were prepared to construct, equip, and work such tramways. Nothing came of this, however, as the offers received were not favourably regarded, and the Corporation themselves finally made application for a Provisional Order, which was granted and confirmed by the Tramways Order Confirmation Act, 1905.



Offices and Car Sheds.

Luton Electricity Station.

Eventually the Tramways Committee were instructed to enter into negotiations with Messrs. J. G. White and Company with a view to obtaining from them an offer to construct, equip, and lease tramways in Luton on lines similar to their agreement with the Dartford Urban District Council, whose tramways the Luton Tramways Committee had inspected. As a result of the negotiations which followed, Messrs. J. G. White and Company agreed to construct, equip, and lease the tramways for a period of five or 15 years at the option of the Council, the Corporation providing the capital and the company paying a rent equivalent to the interest and sinking fund charges during the term of the lease. This offer was accepted by the Council on March 19, 1907. Instructions were then given for an application to be made to the Board of Trade for sanction to borrow £65,000 for tramway purposes, and the borough engineer (Mr. S. F. L. Fox) and the borough electrical engineer (Mr. W. H. Cooke) were appointed joint engineers for carrying out the scheme. On July 4, 1907, the town clerk reported that the necessary sanction of the Board of Trade for the widening of the gauge and the borrowing powers had been received. With respect to the latter an equated period of 27 years was granted for repayment of the full amount of the loan. The total capital cost of the tramways, including the necessary alterations to roadways,



Plan of Feeder System—Luton Electric Tramways.

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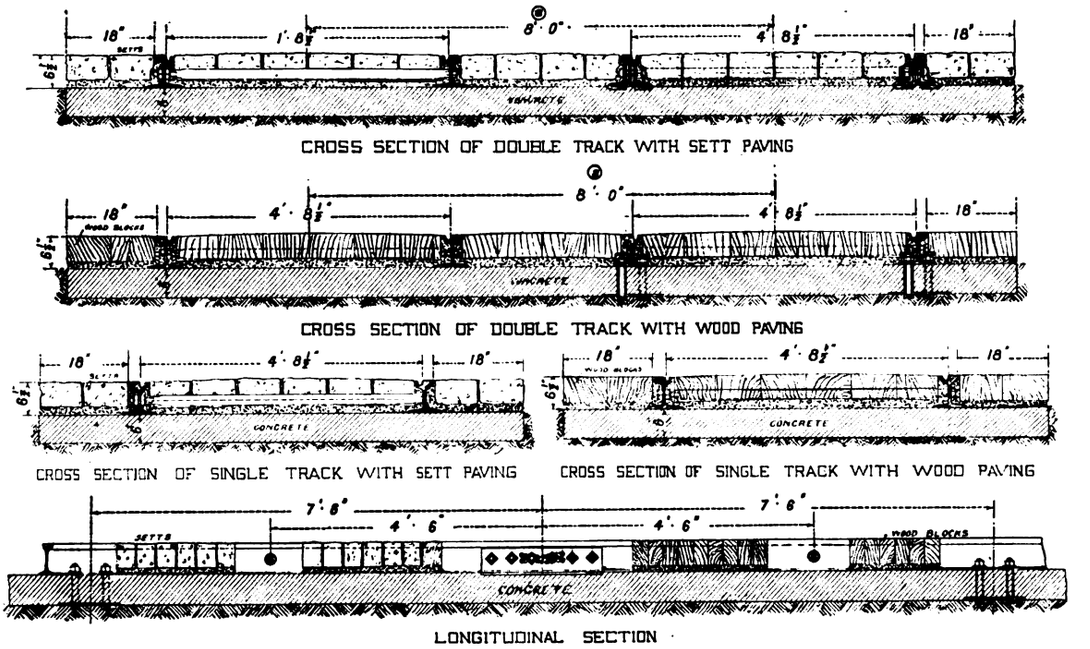
gas and water mains, etc., amounts approximately to £63,000.

The contract for the complete installation, including permanent way, overhead equipment, cables, cars, and car-shed, was placed with Messrs. J. G. White and Company, Limited. The work of construction was only commenced on October 7 last, and, as the contractors have completed the works well within the time stipulated (viz., 4½ months) in the contract, they are to be complimented on the expeditious manner in which the work has been carried out.

The tramways are constructed on the familiar overhead trolley system; and the total mileage authorised by the Luton Corporation Tramways Order, 1905, is approximately 6½ miles, of which there are now in operation about 5¼ miles of route, equivalent to 6¼ miles of single track.

straight track and No. 2C for curves, weighing about 95 lb. and 101 lb. per yard lineal respectively; they are of the girder pattern and in 45 ft. lengths. The rails are laid on a bed of concrete 6 in. thick, composed of one part of Portland cement to six parts of gravel. The cement was supplied by the Associated Portland Cement Company. The rails are joined by means of continuous rail joints 24 in. long, weighing 100 lb. per pair, and were supplied by the Continuous Rail Joint Company. No anchor joints were used, but intermediate anchors were employed, spaced 5 yards apart. Fishplates are used only upon special work. They are drilled with six holes to take one inch diameter bolts, and were supplied by the North Eastern Steel Company. Soleplates are only used at points and crossings. They are of ¾ in. rolled steel, supplied by Messrs. Naylor Brothers.



Sections of Track—Luton Tramways.

The lines constructed run from Park Street, where the depôt is situated, *via* George Street and Upper George Street to opposite the Laundry in Dunstable Road; from Round Green, *via* High Town Road and Mill Street, to New Bedford Road; from Wardown Park, *via* New Bedford Road, to George Street; and from a terminus near Trapps Lane on the London Road, *via* Ashton Road, Hibbert Street, and Chapel Street, to George Street. The population of the district served is approximately 40,000. Excepting for a very short gradient of 1 in 11, and one of 1 in 12½, and a fairly long gradient of 1 in 14½, the inclinations are comparatively easy. The curves having a radius of less than 50 ft. are 5 in number, and vary from 36 ft. to 49 ft.

The gauge is 4 ft. 8½ in. The rails, which were supplied by the North Eastern Steel Company, are British Standard Section No. 2 for

The length of the points is 12 ft., and they are made of manganese steel with 150 ft. radius. These, as well as the crossings, were supplied by Messrs. Edgar Allen and Company. The special track work was constructed by Messrs. J. G. White and Company. No automatic point shifters are employed.

The track is paved with granite setts, and in some cases with Jarrah wood and creosoted deal blocks. The rails are bonded by concealed bonds supplied by the Forest City Electric Company. The track is cross-bonded at every 80 yards. The necessary lowering of the roadway and alterations to gas and water mains, etc., under the railway bridges, has been carried out by the Corporation's Highways Department.

On all sections, side poles of standard type weighing 700 lb., 900 lb., and 1,100 lb., supplied by Messrs. John Spencer, Limited, have been erected. The bracket arms have a length

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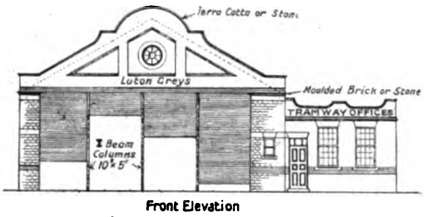
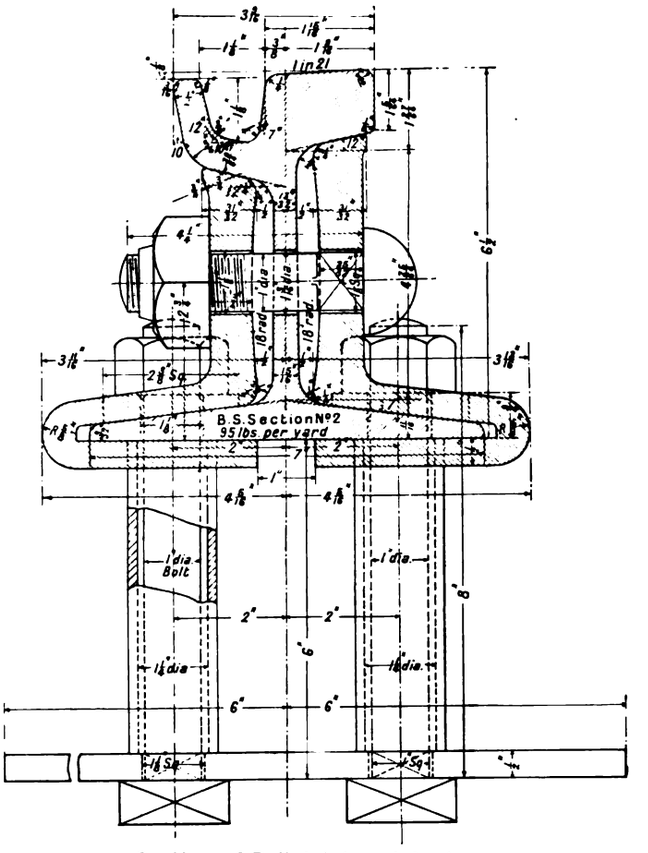
varying from 8 ft. to 16 ft., and in eleven cases wall rosettes were employed. The pole bases were supplied by Messrs. William Boydell and Sons.

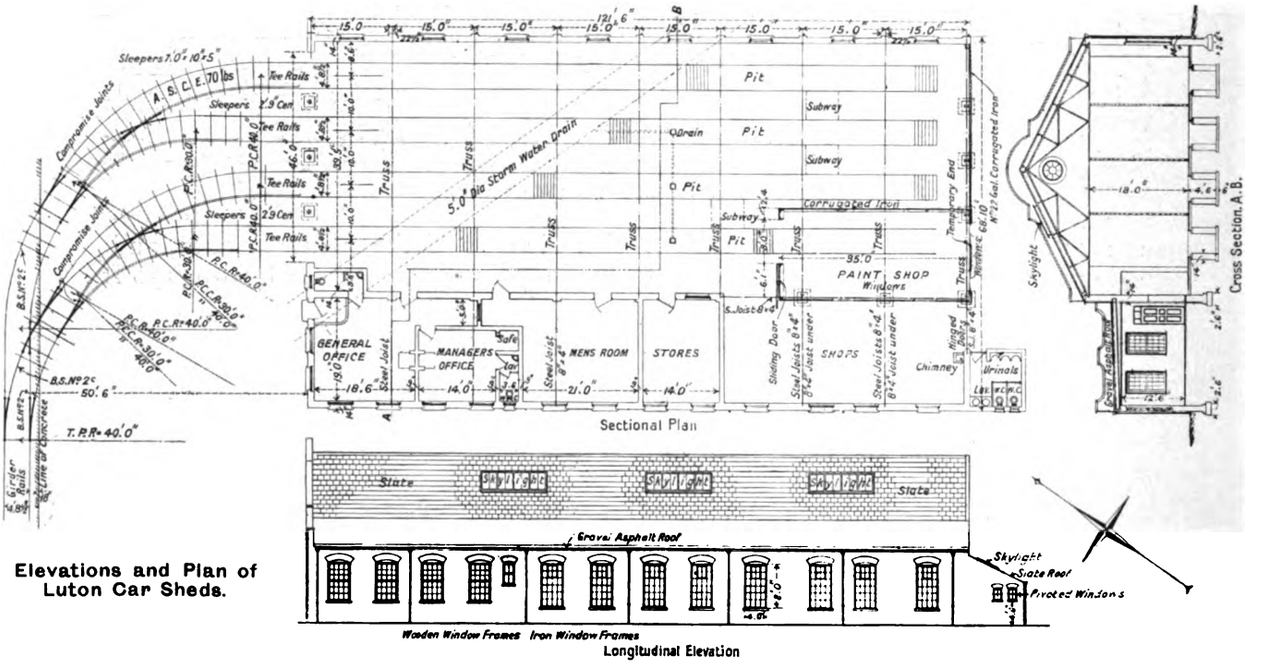
The trolley wire, which is of grooved copper, 2/0 B. and S. gauge, supplied by W. F. Dennis and Company, is suspended by means of flexible supports of 7/14 S.W.G. galvanized mild steel wire, stretched between two globe strains, both doubly insulated. The ears are mechanical ears, and were supplied by the Electric Tramway Equipment Company. They are made of gun-metal, and for the greater part are 6 in. long, but in some cases 14 in. and 18 in. ears are used. The frogs are cast bronze, and consist of mechanical, diamond, and open types, also supplied by the Electric Tramway Equipment Company. The feeder pillars, furnished by Messrs. Estler Brothers, contain two 300 ampere quick-break knife switches, four 100 ampere knife switches, and lightning arrester, test and telephone terminals, all of which are mounted on a marble slab, polished on both sides. The section boxes contain two 100 ampere quick-break knife switches, and were supplied by the same firm. The guard wire is of 7/16 galvanised steel, supplied by F. Smith and Company. All guard wire is earthed, and where guard wire is used



Front Elevation



Section of Rail Joint and Anchor.



Elevations and Plan of Luton Car Sheds.

every fifth pole is securely bonded to the rails. The total length of cable used is 1·17 miles. It has been supplied by Messrs. Henley, and laid solid in wood troughs.

The car shed is a handsome building, faced with Luton greys. It is 121 ft. 6 in. long and 48 ft. 6 in. wide, and accommodates 16 cars. It has 4 tracks, each supplied with a pit, and there are in addition a repair shop, stores, and offices.

There are 12 double-decked cars, which have been supplied by the British Thomson-Houston Company, of Rubgy, to Messrs. J. G. White and Company. The bodies are by the United Electric Car Company, and are mounted on

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single trucks, supplied by Messrs. Mountain and Gibson, of Bury, and are fitted with both wheel and track brakes. The equipments of cars were also supplied by the British Thomson-Houston Company, and include two 4-pole, 500 volt. series motors of 30 H.P. each per car, with controllers, etc.

The trolleys are of the swivelling arm type, with detachable heads. The car roof is of bent ash, plated where necessary, covered with tongued and grooved pine, and the ceiling is three-ply maple veneer, with oak mouldings. Illuminated destination signs are mounted over the canopy at each end, and the cars are lit with twelve 16 candle-power lamps. Each car is supplied with a Hudson and Bowring lifeguard. The cars will carry advertisements in the usual spaces, and a considerable revenue will be obtained from this source.

Interior of Electricity Works, Luton.

The electrical energy for operating the tramways is supplied by the Electric Light and Power Committee from their power-station in St. Mary's Road. This generating station was laid down for general supply in the early part of 1901, and was opened by the late Lord Kelvin on July 10, 1901. The plant then consisted of three high-speed engines and generators and one steam balancer, all by Messrs. W. H. Allen, Sons, and Company, Limited, Bedford, of a total capacity of 297 KW., with condensing plant by Messrs. Joseph Wright, of Tipton, two 30 ft. by 8 ft. Lancashire boilers by Messrs. Tinkers, Limited, Hyde, and a Green's economiser.

The capital expenditure was £25,000, including distributing mains. Mr. Albion T. Snell, of London, was consulting engineer for the original scheme, the present electrical engineer (Mr. W. H. Cooke) being resident engineer during the installation. Owing to the increased demand for light and power purposes an additional 350 KW. engine and generator of Messrs. W. H. Allen, Sons, and Company's make, and another 30 ft. by 8 ft. Lancashire boiler, fitted with mechanical stokers, was installed at the latter end of 1905.

In 1907 the demand for power and lighting purposes had so increased that it was necessary again to extend the plant. To meet these requirements an additional 45 ft. was added to the engine room and boiler house, and a 500 KW. engine and generator by Messrs. W. H. Allen, Sons and Company, of Bedford, has been installed. An additional condensing plant by the Worthington Pump Company, of Newark, a 30 ft. by 9 ft. Lancashire boiler by Messrs. Ruston, Proctor and Company, of Lincoln, and a motor-driven "Sinclair" feed pump by Messrs. Hayward, Tyler and Company, Limited, of Luton, have been fixed. The remaining two boilers and the new boiler has been fitted with Messrs. Bennis' patent compressed air mechanical stokers, and a complete coal handling plant fixed, consisting of steel overhead coal bunkers with elevator and conveyor by Messrs. R. H. Longbotham and Company, of Wakefield. The new steam, exhaust and feed piping with a Harris-Anderson water purifier has been supplied

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and fitted by Messrs. John Wilson and Company, of London.

A new battery room has also been built over the old battery room for a traction battery, which has been supplied by the D.P. Battery Company, of Bakewell. The traction switchboard was made by Messrs. Johnson and Phillips, of Charlton, Kent, and the reversible booster by the Lancashire Dynamo and Motor Company, of Trafford Park, Manchester. The tramways are supplied by one of the 85 KW. generators, which has been fitted with change-over switches, working in conjunction with the battery and reversible booster. The total capacity of the station is now 1,147 KW., and the capital expenditure about £56,000.

The whole of the extensions to the machinery and plant, including that required for traction purposes, has been designed by the electrical engineer (Mr. W. H. Cooke), and the extension to the buildings by the borough engineer. Mr. G. W. Buckingham, of Luton, was the contractor for the latter portion of the work.

Proposed Tramway in La Plata.—The *Review of the River Plate* states that Messrs. Alvaro Pintos and J. H. Martin have applied to the La Plata municipality for a fifty years' concession for an electric tramway in that city. There are also petitions for electrification by existing companies.

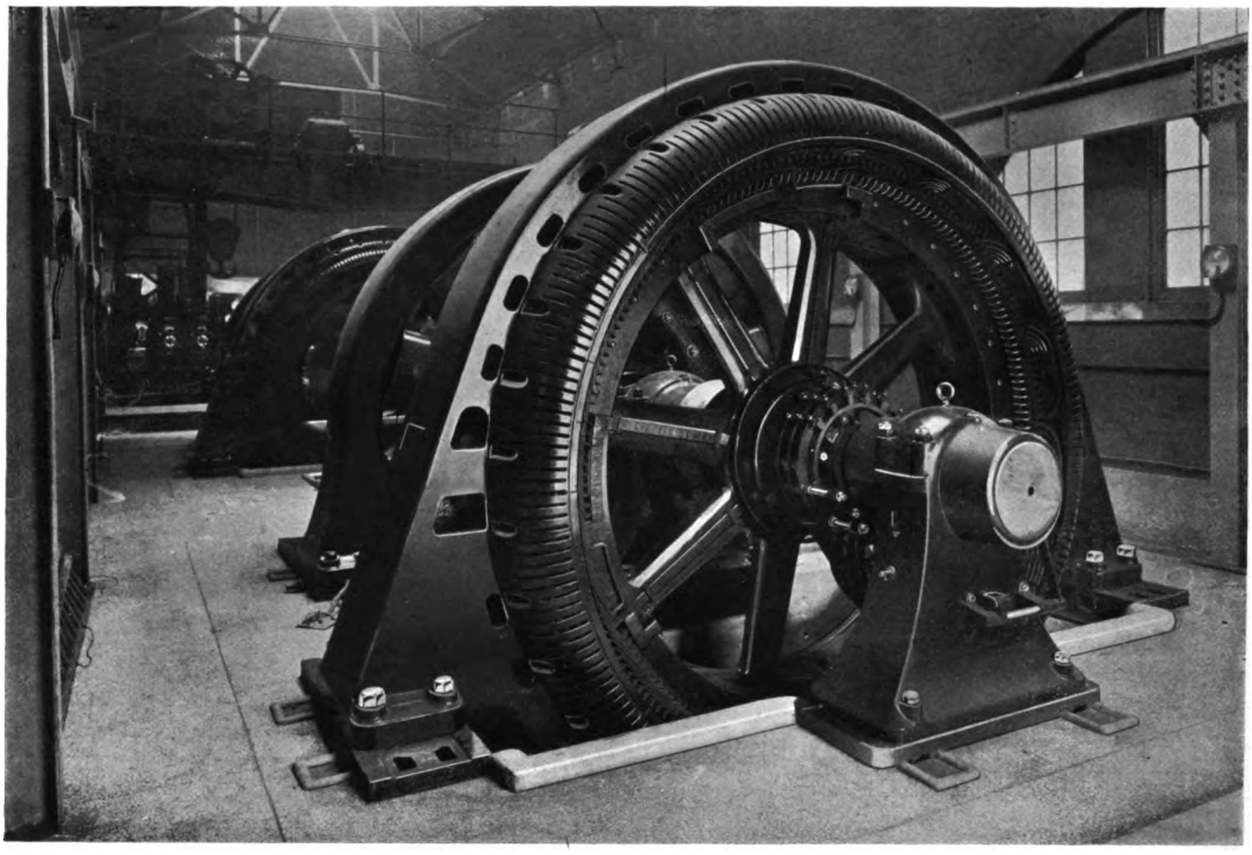
Completion of Shanghai Tramways.—The Shanghai Electric Construction Company intimates that the construction and equipment of the electric tramway system in Shanghai are now complete, and the feeder cables are being connected with the municipal generating station. A supply of power sufficient to permit of traffic being opened was expected to be available on March 1.

LARGE MOTOR GENERATORS FOR THE LONDON COUNTY COUNCIL.

In the illustration below are shown the two 1,500 KW. induction motor generators supplied by Messrs. Dick, Kerr and Company, for the London County Council tramways, which are installed in the Elephant and Castle sub-station. Each of the machines has an output of 1,500 KW. at 500-550 volts direct-current, and any speed from 133 to 135 revolutions per minute, and can carry 25 per cent. overload continuously for one hour. The induction motors are of the wound rotor type, with slip rings for inserting the starting resistance, the stator being wound for the full normal pressure of 6,600 volts between the three phases, and a frequency of 25 cycles per second.

The induction motor stator consists of a heavy cast iron ring cast in one piece, separate from the baseplate to which it is bolted by turned and fitted bolts. The core plates are thin steel punchings, re-annealed after punching, which are securely clamped between end plates drawn up by heavy bolts. Ventilating spaces are provided along the length of the stator core, corresponding to similar spaces in the rotor core. The stator windings are enclosed in micanite troughs, the external loops being taped and finally finished over with varnished cord. These loops are protected from mechanical injury by ventilated cast iron guards. The rotor is built up on a solid spider of cast steel, keyed to the shaft. The core is made up of thin steel stampings, ventilated throughout its length, and well clamped together by end plates. The motor is started up with full voltage on the stator, resistance being inserted in the rotor circuit by means of slip rings which are short circuited when the machine has run up to speed.

These motor generator sets are of interest from the fact that they are the largest of their kind that have been supplied in Great Britain.



Dick-Kerr Motor Generator for the London County Council.

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LONDON COUNTY COUNCIL TRAMWAY MATTERS.

Brixton Road to Camberwell Green Line.

At a meeting of the London County Council on February 4, the Highways Committee submitted a report in reference to the reconstruction on the overhead wire system of the tramways from Brixton Road to Camberwell Green, a distance of 1¼ miles, double track. The route forms part of the system purchased recently from the London Southern Tramways Company, the other portion of which, from Brixton Road to Vauxhall, is now being reconstructed on the conduit system. An estimate of £51,480 had already been approved for street widenings involved. The estimated cost of reconstruction and equipment was:

	£
Track work, including special work and £4,600 for rails	26,600
Cables, cable ducts, etc.	2,000
Overhead equipment...	3,160
Rolling stock	3,150
	£34,910

An estimate had already been approved for rails, and the Committee would report further as to the supply of cars. It was recommended that an estimate of expenditure of £27,160 (this excluding rails and rolling stock) should be approved.

The Finance Committee, reporting on the subject, said that the cost of track work, including rails and overhead equipment, totalled £29,760, or £11,904 per mile of single track. This was higher than other cases of overhead construction which had been before the Council, but the Finance Committee understood that in the present case there was heavy expenditure for lowering the road at places where it was crossed by railway bridges, and for setting back kerbs. The proposals were approved at the following meeting.

Northern Tramway Reconstruction.

The Highways Committee had considered the following tenders for the execution of the road work, exclusive of rails and special track work, in connection with the reconstruction on the conduit system of the tramways in Caledonian Road and Seven Sisters Road of a total length of 2¾ miles, double track:

	£	s.	d.
Dick, Kerr and Co.	53,516	15	10
R. W. Blackwell and Co.	55,013	5	10
W. Manders	56,681	7	4
J. G. White and Co.	58,249	14	3
John Mowlem and Co.	59,007	0	0
Edmund Nuttall and Co.	59,917	1	2
W. Underwood and Brother	61,240	14	0
Wm. Griffiths and Co.	62,041	16	7
Wm. Muirhead and Co.	62,110	11	2
National Electric Construction Co.	64,993	11	2
George Law	68,489	0	0

The chief engineer's estimate comparable with the tenders was £58,986 16s. 2d.

The Committee were of opinion that, subject to certain conditions, the lowest tender, viz., that of Dick, Kerr, and Company, should be accepted. The Committee also proposed that Dick, Kerr, and Company should be allowed to sub-let to the undermentioned firms the following portions of the work: (1) To the Anderson Foundry Company, or Wilson, Pease and Company, yokes; (2) to Doultons, or Buller's, insulators; (3) to Bayliss, Jones and Bayliss, tie-bars, bolts, etc.; (4) To the Associated Portland Cement Manufacturers, cement.

The recommendations were adopted.

At the meeting of the Council on February 11, the Committee reported that they had considered the following tenders for the laying of cable ducts in connection with the same tramways:

	£	s.	d.
Dick, Kerr and Co.	3,375	17	8
Clift Ford, Willesden Junction	3,734	14	10
W. Muirhead and Co., Queen Victoria Street, E.C.	3,748	4	1
D. R. Paterson, Ltd., Camden Town	3,804	8	11
The Westminster Construction Co.	3,881	10	0
John Mowlem and Co.	4,067	4	5
Greig and Matthews, Queen Victoria Street, E.C.	4,196	19	5
Callender's Cable and Construction Co.	4,200	11	3
Reid Bros., Wharf Road, N.	4,539	7	2
Fry Bros., Greenwich	4,741	15	3
J. A. Ewart, Westminster	4,811	3	10

It was recommended that the lowest tender, that of Dick, Kerr and Company, should be accepted.

The following tenders had been received for the manufacture, delivery, and laying of low-tension electric cables and telephone cables:

	£	s.	d.
Johnson and Phillips	4,020	18	4
British Insulated and Helsby Cables	4,056	18	3
Western Electric Co.	4,070	2	2
Siemens Bros. and Co.	4,093	17	9
W. T. Henley's Telegraph Works	4,118	16	10
Callender's Cable and Construction	4,148	16	3
W. T. Glover and Co.	4,401	16	11
Union Cable Co.	4,768	18	10

The Committee proposed that the lowest tender, namely, that of Johnson and Phillips, should be accepted.

The recommendations were approved.

Assistant Rolling Stock Superintendent.

On February 4, the same committee announced that 113 applications had been received for the position of assistant rolling stock superintendent, rendered vacant by the promotion of Mr. W. E. Ireland to be rolling stock superintendent. After consideration the Committee proposed (and the Council now agreed) that Mr. S. H. May, tramway engineer and rolling stock superintendent to Blackpool Corporation, should be appointed. The salary is £250 per annum.

Wandsworth Road Tramways.

At the meeting of the Council on February 11, the Highways Committee reported on preliminary arrangements for the reconstruction on the conduit system of the horse tramways from Nine Elms Lane, *via* Wandsworth Road, etc., to East Hill, Wandsworth. It was hoped that it would be practicable to undertake the reconstruction as part of the programme for the year 1908-9. The committee recommended approval of an estimate of £7,000 for the removal or diversion of mains, pipes, wires, etc., necessary for the reconstruction, and that this work should be executed by the Metropolitan Water Board and by the companies concerned. The total cost of road work was estimated at £138,000, which included the figure of £7,000 now put forward. In accordance with the standing orders this recommendation stood over for a week, when it was adopted.

Draught Screens for Roof Covers.

In reference to the recent decision to provide draught screens for roof covers on 50 cars, the Committee now recommended, and the Council agreed, that the provision of similar screens for the remaining 373 cars which had draughty covers should be carried out. The cost is £10 a car, of which £8 will be charged to capital and £2 to revenue. About 150 of the cars will be dealt with in the financial year of 1908-9, and 223 in 1909-10. The work will be carried out under the management of the Committee by the direct employment of labour.

Issue of Tokens.

The Committee reported on the working of the scheme authorised in October, 1904, for the issue of tokens for use on the tramways by members of the staff, by employers of labour for distribution to employees, and by the general public. Certain large companies and other employers of labour had purchased tokens, but generally speaking little advantage had been taken of the system by the general public. The Committee accordingly proposed to discontinue the sale of tokens to private individuals as distinct from large firms, etc.

Steamboat Services.

The Highways Committee also presented a report on the Thames steamboat services, in which it was shown that since the service was started in 1905 there was a deficiency on the working, including capital charges, of £137,083. The capital expenditure amounted to £301,081. The committee proposed that steps should be taken to dispose of the boats either by selling or chartering them. It was anticipated that if the boats were laid up the annual loss would be reduced from about £42,000 per annum to £27,000. This was without allowing for selling any of the boats.

Consideration of the matter was postponed, but the proposal was adopted at the following week's meeting.

Cars for Women Only.

Alderman Thompson stated, in reply to questions, that steps were being taken to diminish overcrowding on workmen's cars from Tooting in the early morning, and that a car reserved for women would be tried as an experiment.

Increase of Salaries.

At a meeting of the Council on February 18, several committees presented reports as to the annual revision of salaries which takes place in the month of February. In regard to the tramways department, the General Purposes Committee recommended that the salary of Mr. A. L. C. Fell, chief officer of tramways, be increased from £1,500 to £1,750 a year. They pointed out that since Mr. Fell's appointment additional tramway undertakings had been acquired, and a large proportion of the lines reconstructed for electric traction. As an illustration of the rapid growth of the service, the number of passengers had increased from 126,388,845 in 1903, which was the year of Mr. Fell's appointment, to 351,407,794 in 1907, while during the same period the receipts had increased from £489,339 to £1,536,196. At the time that the salary of £1,500 was fixed, it was not contemplated that the northern tramways would be taken over before 1910.

The Establishment Committee recommended that the salary of Mr. W. C. Copperthwaite, bridges' engineer, should be increased from £800 a year to £900 by two instalments of £50. Mr. Copperthwaite was appointed in 1902, and his work had greatly increased, particularly in connection with the reconstruction of tramways.

The Establishment Committee also proposed that Mr. A. S. Campbell, now temporarily engaged as resident engineer on the electrification of tramways at £8 per week, should be placed on the permanent staff in the position of principal assistant in the engineer's department, at a

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salary of £425 a year. Mr. Campbell had been in the service for five years. The position rendered vacant by the resignation in August, 1904, of Mr. S. A. Colam, had been advertised twice, but the Committee were advised that no suitable candidates could be obtained by the advertisements, owing to the small number of engineers possessing practical experience of conduit tramway work.

The Highways Committee recommend increases of salaries in the case of 22 officials. They proposed that Mr. E. L. Pope, resident-electrical superintendent, who had direct control of the sub-stations, electrical cables, etc., on the southern tramways, who had a large staff under his supervision, and who had performed his duties in a highly satisfactory manner, should have his salary increased from £400 to £425. They further recommended that Mr G. Dickens, superintendent of stores, who attended to the ordering, keeping, and the issuing of the various stores, should be granted an increase of salary from £250 to £300 a year, but that in future he should not be paid for overtime at the annual stocktaking.

In addition to increases proposed for a number of clerks, etc., the following further advances were recommended: Mr. C. R. Johnson, a district traffic superintendent, from £265 to £280; Mr. H. R. Saxty, building superintendent, from £265 to £280; Mr. J. Glover, superintendent of claims, from £260 to £275; Mr. E. Cloney, principal assistant to a district traffic superintendent, from £200 to £220.

The recommendations as to the increase of Mr. Fell's salary and those of the Highways Committee regarding increases to other officials were adopted, while the report of the Establishment Committee in regard to engineers' salaries was postponed, but was agreed to a week later. In regard to the increase of Mr. Fell's salary, Mr. Thompson, Sir John Benn, and others, recognised the work of Mr. Fell, whose responsibilities for the successful working of a great municipal service, they pointed out, were immense.

Tramway Construction by Works Committee.

The Works Committee in their statement for the half-year ended September 30 last, reported that they had carried out the track construction of Lewisham to Lee Green tramways for £28,086, being £2,020 less than the final certificate. They had also constructed foundations for additional machinery at the Elephant and Castle sub-station for £1,252, being £99 below the final certificate. The Committee strongly complained of the small quantity of work of all kinds entrusted to them recently by the Council, and pointed out the necessity, in order to secure economy and to enable the heavy standing charges to be borne, of referring to the department a sufficient quantity of work.

The Highways Committee reported that the two pieces of work done for them by the Works Committee had been executed in a satisfactory manner. They also stated that the tramways department had themselves, by the direct employment of labour during the half-year, carried out repair and maintenance works on the tramways at a cost of £108,988. They had also executed new works of a limited nature at various places at a cost of £3,711.

At a meeting of the Council on February 25, the Highways Committee reported as to money still required for cables and cable ducts in connection with the reconstruction of the

Brixton to Streatham Tramways.

It had been thought that votes already passed made provision for these cables and cable ducts, but it was now found that none of the estimates contained specific provision for them. The contracts had for some time been completed, and the cost had been apportioned between the several tramway routes, the amount in respect of the Brixton to Streatham line being £17,300. A specific estimate for this amount was, therefore, necessary, although it did not involve any further expenditure. Consideration of the estimate now presented for approval was postponed.

Purchase of a Bexley Tramway.

In reference to the construction on the trolley system of lines from Beresford Square, Woolwich, to the Bexley tramway, near Wickham Lane, and from the Bexley lines at Wickham Lane to Abbey Wood, the Committe pointed out that in order to secure a through route the intervening portion between the two authorised lines, about 150 yards traversed by tramways of the Bexley Urban District Council, was purchasable by the County Council under their Act of 1904. The price to be paid was the cost of construction less a reasonable amount for depreciation. The price stated by the District Council was £1,170, and it was recommended, and the Council now agreed, that the estimate for £1,250 should be approved, and that the purchase should be carried out when the construction of the Council's authorised lines from Beresford Square to Wickham Lane were completed. Under agreement the District Council was entitled to running powers for two years over the purchased portion and over the County Council's lines as far as Beresford Square.

Miscellaneous Contracts.

It was recommended that an existing contract with P. and W. Maclellan, Limited, for flat-bottomed rails should be extended by 115 tons of rails required for the first portion of the central car repair depôt, in Woolwich Road, at £7 6s. 3d. per ton, which was 2s. 6d. per ton less than the price of the existing contract. The total expenditure, including bolts and fish-plates, would probably not exceed £936.

The Committee stated that arrangements had been made to instal at Hammersmith temporary sub-station two of the 500 KW. machines which were being made by the Electric Construction Company. A further 150 KW. machine would also be necessary for starting the larger machines, and for other purposes, and the Committee believed that the best and most economical course was to extend the contract with the Electric Construction Company, so as to include this additional machine. The company would supply it for £541 10s.

A tender for the supply of 300 plough bases at 54s. each and 600 leads at 4s. each by the India-Rubber, Gutta Percha, and Telegraph Works Company had been accepted by the Committee. The expenditure will be charged to revenue account.

The contracts were confirmed.

CREOSOTED PAVING AND PLANTS.

A case from Bristol which has been twice before the local Court during the last year or two came before the King's Bench Division in London on February 3. The action was that of West (a market gardener) against the Bristol Tramways Company, and by it the plaintiff sought to recover damages for injury alleged to have been caused to plants and shrubs belonging to him by fumes and dust from creosoted wood blocks used for paving the tramway track which adjoins his premises in Bristol. When the case was first heard in the Bristol Tolzey Court the jury failed to agree. After a considerable interval, there was another trial of the case in the same Court, when the jury found that the injury to the plants was caused by the wood paving used by the defendants, that it was not absolutely necessary for them to pave the road as they did at the time they did it, and, in answer to a supplemental question, that it was reasonably necessary for the defendants to repave the road in the way they did and at the time they did according to the knowledge of the defendants at the time, but that in the light of the evidence given at the hearing it was not reasonably necessary. Upon these findings the Recorder entered judgment for the plaintiff. The defence was that the damage, if any, was not due to the creosote, and that the defendants were protected by the Bristol Tramways Act, 1894, which provided for wood paving being used. The appeal was taken by the defendants against the decision of the Recorder.

Mr. Justice Phillimore, who gave judgment, said that the appeal must be dismissed. The finding of the jury that the damage to the plants was caused by creosote fumes or particles was certainly a startling conclusion to come to, and he would not say that the last word of science had necessarily been said upon the subject. That finding of the jury put the defendants to their justification. It was no justification for a man who used real property in such a way as to injure his neighbour's property to say he had no intention of injuring it, or he did not know he was injuring it. In this case the defendants claimed to have statutory justification. If Parliament ordered a thing to be done and mischief ensued from the doing of the very thing ordered, the subject doing the thing was entitled to avail himself of the authority of Parliament. If Parliament ordered a thing to be done and there was only one way of doing it, then Parliament had as much ordered the doing of the thing in that way as if it had expressly ordered that way to be employed. In the present case Parliament had authorised and, indeed, commanded, the tramway company to keep in repair portions of the highway, and it had authorised and commanded this to be done by paving these portions of the road with wood. If there was only one form of wood pavement known to Parliament that would be the one authorised, but it happened that there were two such forms. One was the process of using a softer form of wood and hardening it with creosote, and the other was the process of using a hard wood, such as Jarrah wood. Here the tramway company showed that there were various advantages in using soft creosoted wood; but they did not show that it was the only way of paving this road, nor that it was the only method which Parliament contemplated being used. It seemed to him, therefore, that, while the defendants could plead the authority of Parliament for paving with wood, they could not plead the authority of Parliament for paving with creosoted wood. The mischief done here, was not due to the wood, but the creosote. And if the use of creosote was dangerous, the defendants had no authority to use it. Upon that ground alone it seemed to him that this action should succeed. As to the findings of the jury, in his opinion they amounted to a verdict for the plaintiff.

Mr. Justice Walton was of the same opinion, and the appeal was dismissed.

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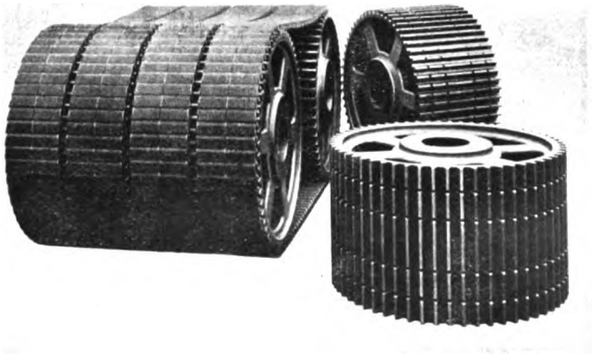
LARGE MORSE CHAIN DRIVES

The Westinghouse Brake Company, of 82, York Road, King's Cross, London, inform us that they have recently executed an order for what is probably the biggest chain-power transmission yet attempted. This order consists of three Morse silent high-speed rocker-joint drives complete, each to transmit 500 H.P. These drives were ordered by an



Morse Chain Drives for Transmitting 500 h.

engine-works in Russia, Government of Moscow, which already has a 280 H.P. Morse drive in satisfactory operation.

The accompanying illustration gives a good idea of the appearance of these large drives, of which the following are further particulars: Diameter of wheels, 37·78 in.; face width, 22 in.; wheels, 2 in. pitch, 10 in. wide. Two chains running side by side over one set of wheels.

BRUCE PEEBLES AND COMPANY, LIMITED.

An extraordinary meeting of this company was held in Edinburgh on Monday, for the purpose of considering a resolution for the voluntary winding-up of the company with a view to reconstruction. Mr. W. Carmichael Peebles, who presided, said that the conditions with which the company had had to contend were, (1) the need of further working capital for the carrying on of the business, accompanied by the extreme stringency of the money market; (2) for the same reason the stoppage of practically all new contract work; (3) the very high prices of raw material; (4) the low price obtainable for the company's ordinary manufactures through undue competition. It had been found impossible to raise further money on a satisfactory basis owing to the condition of the money market. All new contract work had been delayed, whereas, had they been going on during the year as was fully anticipated, the company would now have been receiving the profits derivable from them. In nearly all cases prices of raw material had been on a considerably higher basis than the company was paying in 1906, and that was particularly the case with reference to copper. When the company was formed the prices obtainable for its ordinary manufactures were nearly double what they were to-day. There had been a constant decline in prices brought about, first, by foreign competition when they had dumping from abroad, and latterly by the continued competition of home firms. The company had some valuable specialities, the benefits from which had only recently begun to tell. With regard to the large Moscow tramway contract, for which the company was in treaty, an option had been obtained and it was hoped it would be of benefit. He wished to impress on the shareholders that the business connection and experience of the company was a valuable one, and that if they agreed to a scheme of reconstruction the company might emerge from the crisis stronger than ever. The joint liquidators would at once consider whether a scheme of reconstruction was feasible. Mr. A. W. Tait (London), who had been appointed provisional liquidator by the court, compared the assets and liabilities of the company at the close of last year with the same at the close of the previous year, and said that the figures showed a net loss of £92,000. The large creditors were sympathetic, and, while the situation was undoubtedly serious, there was every reason to believe that if the shareholders gave the present policy their support, the greater portion of their interest in the company would be preserved. It was unanimously resolved that the company be wound up voluntarily. Mr. Tait and Mr. J. A. Robertson Durham (Edinburgh), were appointed joint liquidators, and were empowered to carry on the business so far as might be necessary for the beneficial winding up or reconstruction. An advisory committee of shareholders was also appointed.

The London "Underground."—About 200 stations will be included in the scheme for through bookings shortly to be inaugurated on eight London Underground railways.

THE INTERNATIONAL TRAMWAYS CONGRESS.

The Bavarian Government and the city of Munich have now definitely fixed the date for the fifteenth congress of the International Tramways and Light Railways Union. The congress will be opened on Monday, September 7, and will be continued on Tuesday and Wednesday, terminating on Thursday, September 10. The programme of subjects for discussion is as follows:

(1) Corrugation of rails.
(2) Production of electrical energy, with reference to the relative advantages of reciprocating engines and steam turbines, gas motors, Diesel engines, etc.
(3) Comparative advantages of cars equipped with radial axles, or bogies of one or two axles.
(4) Improvement in brakes for electric cars.
(5) Results obtained by the use of meters on cars.
(6) Comparative results obtained by the use of electric traction upon light railway lines.
(7) Wear and life of essential apparatus and their maintenance.
(8) Advantages and disadvantages of motor omnibuses.
(9) Lubrication of bearings and gears.
(10) Construction of light railways.
(11) Types of steam locomotives for light railways.
(12) The use of automobiles and rail motor-cars upon railways in general and specially upon light railways.

LIGHT RAILWAY ORDERS.

The Light Railway Commissioners held a local inquiry at Plymouth on January 31, and approved the application of the Great Western Railway to deviate and extend the Callington Light Railway.

On February 1 the Commissioners approved the application of the Plymouth, Devonport, and South Western Junction Railway for an Order to authorise the extension of the Bere, Alston, and Calstock Light Railway.

On February 3 the Commissioners sat at Crewkerne to hear the application for an Order to authorise the proposed Crewkerne, South Petherton, and Martock Light Railway. The inquiry was adjourned.

The Commissioners have submitted to the Board of Trade for confirmation the Barton and Immingham Light Railway Order, authorising the construction of a light railway in the county of Lincoln (parts of Lindsey) from Barton to Immingham.

The Commissioners have submitted to the Board of Trade for confirmation the Wolverhampton and Cannock Chase Railway (Light Railway) Amendment Order, 1908, amending the Wolverhampton and Cannock Chase Railway Act, 1901, and the Wolverhampton and Cannock Chase Railway (Light Railway) Order, 1907, in reference to the fund deposited in respect of the application for the Act of 1901.

The Light Railway Commissioners held an inquiry at York on February 25 regarding the application by York Town Council for an Order to construct electric light railways in the city. For the promoters it was stated that these light railways, or tramways, would serve a population of 91,000. The question whether the lines should be constructed and worked by the Corporation, or whether there should be a lease to a company for construction or working or both, was left open for the decision of the ratepayers by a vote. The estimated cost of the lines was £128,000, and there was sufficient plant in the Corporation's electric lighting station to supply the power for working the tramways. Among the witnesses for the promoters was Mr. J. B. Hamilton, general manager of Leeds Corporation tramways, who said that, as the result of inquiries, he estimated that there would be a revenue of £31,895 a year, that the working expenses would be about £20,081, leaving a gross profit of about £11,794; interest and sinking fund would probably mean £7,500 a year; in all he estimated a net profit of £2,294. Opposition on points of detail was heard from the North Eastern Railway Company, after which the Commissioners granted the Order, subject to certain provisions on minor matters.

The Board of Trade have confirmed the Stottesdon, Kinlet, and Billingsley Light Railway Order, 1908, authorising the construction of light railways in the county of Salop, from Stottesdon to Billingsley, and the Portsdown and Horndean Light Railway (Extension, etc.) Order, 1908, authorising the construction of a light railway in the parish and rural district of Catherington, in the county of Southampton, in extension of the light railway authorised by the Portsdown and Horndean Light Railway Order, 1898, and for other purposes.

Messrs. L. P. Winby and Company have made arrangements for undertaking the testing and inspection of engineering materials of every class at makers' works. At their branch offices at Liege, Belgium, and Duisburg, Germany, they have a staff of their own inspectors. Messrs. Winby have made arrangements with several leading firms of contractors for undertaking the inspection of their material.

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FINANCIAL COMMENT.

The year began with many hopeful prognostications of what was in store for the stock-markets. It was anticipated that the many gains from recent trading that kept our shipping and railway companies busy during the last eighteen months or two years were about to be released to seek investment in stock exchange securities. So far there has not been much sign of any such thing taking place. Most of the railway companies now record declines in their traffic receipts, and the shipping business is depressed, so that the conditions requisite for a release of capital from trade are perfectly fulfilled. On the stock exchange, at Christmas time, prices were hoisted, and every preparation made for dealing with the released funds, but it would seem they have failed to put in an appearance, so the preparation was wasted, and prices have now sagged to a point not much better than that which characterised the late autumn of lugubrious memory. Readers who studied our first instalment of financial comment in the January number of this year will have no cause for surprise at the present condition. No doubt there are funds awaiting investment, but not enough to meet the wants of the innumerable governments, corporations, and incorporate undertakings anxious and waiting to borrow them. And not only are borrowers more numerous and ready than heretofore, but funds to be invested are probably less than have been available after like periods of trade prosperity in the past.

During the recent activity of trade, the gains of labour have been much greater than ever before. Now out of the joint action of capital and labour, the proportion of the proceeds secured by the latter is practically all of it spent—*i.e.*, consumed—and annihilated as and when it is earned: probably not more than a few pence in each £100 is saved in any permanent form.

It is different with the proportion secured by capital. It is the habit of capitalists to save, they would not be capitalists if it were not. Consequently of every £100 which goes to the remuneration or rent of capital, an appreciable fraction is set aside and generally placed sooner or later in some form of security dealt with upon the stock exchange. The amount of money so destined is on this occasion smaller, relatively to the wealth and population of the kingdom, than was, from former experience, to be expected. But if labour had secured, in the prosperous times that preceded 1890, as large a share of the joint production of capital and labour, as during recent years, the money that created the grand investment demand that characterised the later nineties would never have been accumulated.

THE DUBLIN UNITED TRAMWAYS COMPANY (1896), LIMITED.

This company did well during the six months ending December 31 last. The international exhibition contributed handsomely to the traffic receipts, and the net revenue was nearly £20,000 better, so that although the company were obliged to disburse £6,250 for the exhibition guarantee and reserve another £2,000 against a possible further call on this account, they still felt able to augment the usual distribution of 6 per cent. to the ordinary shareholders, by a bonus of 1s. per share. It would probably have been wiser to keep the extra money in hand: it is sure to be wanted before long, and the additional £6,000 (making £10,000) appropriated from net revenue for reconstruction and maintenance, is none too much for the necessities of the case. Last year the general expenses were charged to the amount of £1,127 for reconstruction of part of the Dalkey line, and in so large an undertaking as this there is no reason, as the cost of renewals and reconstruction become more uniform from year to year with the lapse of time, why all the expenses under these heads should not be charged as general expenses. It is the usual practice in railway accounts, and has the advantage of enabling the shareholders with greater confidence to form an opinion of what is in store for them. However, in the last half-year this precedent was followed to the extent of £113 only.

THE CLONTARF AND HILL OF HOWTH TRAMROAD COMPANY.

The tramway belonging to this company is but five and half miles long. It was constructed under a special Act of Parliament to connect the system of the Dublin United Tramways with Howth Harbour East Pier, and opened to traffic in 1900.

The company has now declared a dividend, the first since its formation, though belief in its success was so strongly and generally entertained at its inception that the shares could be issued at a premium of 25 per cent. on their nominal value.

There is no purchase clause in the Act, and subject to the payment of certain wayleaves, not very onerous, the concession holds in perpetuity. It is a pity with these advantages the company should have done so badly. The traffic available was no doubt very much over rated, but even if this continues to improve at the gradual rate of recent years, the company will be handicapped by the heavy expenditure on capital account, which works out at more than £13,000 per mile, although less than half is laid as with grooved rails and paved track.

In the prospectus a point was made of the building development in progress over the district served, doubtless the general tightness of money has acted as a blight upon this.

LONDON'S UNDERGROUND WAYS.

The poor results which have attended the electrification of the underground lines of communication in the financial centre of the kingdom have been a sore disappointment to its promotors and a discouragement to electrical enterprise throughout the country. The last effect is the more to be deplored in that the industry of electrical manufacture stands in special need of support to enable it to hold its ground in the face of severe foreign competition. The ultimate fate of the underground railways and tubes of London is not, however, so desperate as the recent results of their operation at first sight suggest. The poorness in receipts is plainly due to competition from tramway and omnibus service, much of which was inaugurated contemporaneously with the opening of these underground ways as electric lines. The results, so far, may be regarded as a particularly striking example of the apophthegm, "great are the uses of advertisement." In the case of a tramway the advertisement is costless, but as nearly perfect as advertisement can be. For months while the rails are being laid the fact of its advent is driven home to every possible customer, and immediately it is open, the newly-laid track and the constantly passing cars direct the attention of each and every customer to the new mode of conveyance, at the very moment he has occasion to make use of it. An amount equal to half its capital spent in the ordinary channels of advertisement would not do as much for an underground line. The same causes work in favour of omnibus services, though not to the same extent, and while an underground line must wait for years until its ultimate customers learn to recollect its existence, the motor-omnibus, as it thunders past, dins it into their ears at the physiological instant. Thus the competitors of London's underground ways of communication got a tremendous start, but with time the latter will, undoubtedly, attract a vastly larger proportion of the traffic than at present.

DEBENTURE DEEDS.

A clause with the effect that the terms of a debenture deed may be varied by the votes of a majority of the debenture holders is very commonly inserted in the deed by which the debentures are created.

There have been several occasions of late in which this has worked out to the disadvantage of debenture holders. The holders of junior securities or of shares in the concern may be possessed of sufficient debentures to command the requisite majority, and in that case may find it to their advantage to suffer a reduction of interest and of security in respect of their debenture holding in order to augment the value or marketability of their junior stocks. Again they may have pawned their debentures to creditors not fully secured who would find even a greater net advantage in a like change.

In all such cases the voting is apt to prejudice the position of the single-minded investor who acquired his holding for the sake of the interest promised, at a price proportioned to the security offered. No doubt the debentures of commercial and industrial concerns must inspire less confidence in consequence.

The working of the clause has in certain cases been manifestly unfair, and for the few who have benefited, there are many who will be worse off by having to offer greater inducements to investors in the issue of new loans.

There are a great many concerns just now preparing an issue of debenture stock or anxious to increase the amount already outstanding, and it would not be amiss if the interests of the private investor in debenture were rather more carefully studied.

THE MARKET FOR ELECTRICAL APPLIANCES IN SPAIN.

Our electrical industries have, for many years, been labouring with difficulties that attach to severe depression in business, and, in the present outlook, there are few indications of immediate amelioration. In these circumstances there are unusually strong reasons for scrutinising the less familiar foreign markets, which sometimes offer unsuspected opportunities for trade; and the recent number of diplomatic and consular reports dealing with the trade of Spain deserves particular attention from those interested in electrical manufacture. Among other matter of great interest to manufacturers there are to be found lists of places awaiting the installation of electric light and power-stations, also information relating to the law and customs of the country, and numerous hints as to the best methods to set about introducing business, so as to avoid obstruction and friction.

Spain affords many advantages for the use of electricity in its varied applications, and the information at hand is sufficient to show that electricity has developed at a great rate and to a high degree during the last years, and has been a means of creating new industries and improving old ones. The natural forces of waterfalls have been utilised in many instances. There is still a vast field for further industrial developments.

Mr. S. P. Cockerell, commercial attaché at Madrid, suggests: "How advantageous it would be for the British electrical trade if the Institute of Electrical Engineers, or some representative combination of British manufacturers, took steps to have an investigation made by someone acquainted with Spain, into the great openings which the country undoubtedly affords." But probably the results of individual enterprise would prove equally satisfactory.

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TRAMWAY AND OMNIBUS SHARES.

Specially Compiled for "The Tramway and Railway World."

Amount Ranking for Dividend.	Shares.	Name.	Div'd. Prev. Half-year.	Div'd. Last Half-year.	Quotations, Feb. 27.	Latest Business Done. Price.	Latest Business Done. Date.	Yield on Buying Price. £ s. d.	Dividend Due.*	Quotations, 1907. Highest	Quotations, 1907. Lowest.
260,007	5	Anglo-Argentine Tramways 6% Cum. 1st Pref.	10%	8%	6—6½	6⅛	Feb. 27	4 16 0	*Apr.*, Oct.	6½	5 21/32
320,000	5	Do. do. 10% Non-Cum. 2nd Pref.	5½%	5 10/32%	8⅛—8⅜	8¼	Feb. 27	5 19 6	June, *Dec.*	8	7½
135,000	1	Associated Omnibus Ord.	...	7½d.	7/16—9/16	...	...	...	...	...	...
75,606	1	Bath Electric Tramways Pref. Ord.	5%	for '06	⅝—¾	11/3	Feb. 5	6 3 3	*Apr.*, Oct.	1	¾
75,000	1	Do. do. 5% Cum. Pref.	5%	5%	13/16—15/16	17/6	Jan. 14	5 6 9	*Jan.* & July	1	13/16
15,000	10	Blackpool and Fleetwood Tramways	9/-	4/-	12½—12¾	12⅝	Feb. 24	5 2 0	22 Aug.	...	...
100,000	16/-	Blackpool, St. Anne's, and Lytham Ord.	...	...	—⅛	...	...	...	...	...	...
50,000	18/-	Do. do. do. 5% Cum. Pref.	...	...	⅛—¼	...	...	...	...	...	...
60,000	10	Bombay Electric Supply and Tramways Co. 6% Cum. Pref.	4/8·377	5/2·176	9⅜—9⅞	9 11/16	Feb. 19	6 1 6	Feb., Aug.	8⅜	7⅜
75,000	5	Brisbane Electric Tramways Investment Co. Ord.	...	2/-	3 9/16—3 13/16	77½	Feb. 10	2 12 6	*May.*	3 7/16	1 11/16
75,000	5	Do. do. do. do. 5% Cum. Pref.	5%	2/6	4⅝—4⅞	95/-	Feb. 12	5 2 9	*May*, Nov.	5 1/16	4 9/16
50,000	10	Bristol Tramways and Carriage Co....	8½	9½	12½—13	13	Feb. 20	6 18 6	*Feb.*, Aug.	15¼	14
50,000	10	Do. do. do. 4% Cum. Pref.	4	4	8½—9	9	Feb. 20	4 9 0	...	...	...
400,000£	Stk.	British Columbia Electric Railway Def. Ord.	8%	for '07	127—130	128	Feb. 7	5 16 3	May, Nov.	135	122½
300,000£	Stk	Do. do. do. Pref. Ord.	6%	for '07	106—110	108½	Feb. 18	5 16 9	May, Nov.	116½	105
300,000£	Stk.	Do. do. do. 5% Cum. Perp. Pref. ...	5%	for '07	104—107	105	Feb. 17	4 13 6	May, Nov.	110¾	101
131,301	10	British Electric Traction Ord.	6/-	...	1¼—1¾	32/6	Feb. 17	...	Apr., *Oct.*	4 17/32	1¼
161,437	10	Do. do. 6% Cum. Pref.	6/-	...	4½—5	95/-	Feb. 22	...	Feb., *Aug.*	8½	4¼
100,000	5	Buenos Ayres and Belgrano Electric Tramways Ord.	3/-	for '07	4⅝—4⅞	92/6	Feb. 6	3 1 6	*Apr.*, Oct.	4 9/16	2 31/32
40,000	5	Do. do. do. "A" 6% Cum. Pref.	6%	for '06	4⅝—5⅛	5	Jan. 22	5 17 3	*Apr.*, Oct.	5½	4¾
27,500	5	Do. do. do. "B" do.	6%	for '06	4⅝—5⅛	5	Feb. 10	5 17 3	*Apr.*, Oct.	5⅜	4¾
113,436	5	Buenos Ayres Grand National Tramways Ord.	...	...	2½—3	53/1½	Jan. 3	...	*Jan.*	3⅜	2
90,000	5	Do. do. do. 5% Cum. Pref. ...	3/-	2/6	3¾—4¼	85/-	Feb. 10	5 17 9	...	4¾	3¾
137,610	5	Calcutta Tramways Ord.	7%	3/6	6¾—7¼	7 3/32	Feb. 27	5 14 6	*Apr.*, Oct.	8 15/32	6⅜
30,000	5	Do. 5% Cum. Pref.	5%	2/6	5—5⅜	5 3/16	Feb. 27	4 13 0	Jan., July	5⅜	5 1/16
491,222	1	Cape Electric Tramways	...	...	3/16—7/16	5/-	Feb. 27	...	Feb., *Nov.*	9/16	⅛
15,000	10	Carthagena and Herrerias Steam Tramways	7	6%	5—6	5	Feb. 20	13 6 9	*June*	11¼	6 23/32
40,000	5	City of Birmingham Tramways 5% Cum. Pref.	10%	...	4¾—4⅞	92/6	Feb. 22	5 5 3	*Apr.*, Oct.	5½	4 5/16
248,000	5	City of Buenos Ayres Tramways (1904)	5%	1/3	5 3/16—5 9/16	5 13/32	Feb. 20	4 11 0	*Apr.*, Oct.	5½	4 29/32
60,000	1	City of Carlisle Electric Tramways	1¼%	for '06	2/-—2/6	...	...	...	*Feb.*	...	...
5,000	10	Clontarf and Hill of Howth Tramways	...	1%	6—6¼	6¼	Feb. 5	...	...	...	...
11,500	10	Cork Electric Tramways and Lighting Co.	10/-	ann.	9¼—9¾	...	...	5 2 9	*Mar.*	9¾	8¾
12,327	10	Do. do. do. 5% Cum Pref. ...	5/-	5/-	9¾—10¼	10	Feb. 26	4 17 9	Jan. 1, Dec. 30	...	...
3,000	10	Dublin and Lucan Electric Railway 5% Cum. Pref.	5/-	5/-	...	...	...	...	Sep. 15, Aug. 29	...	...
1,900	10	Do. do. do. Ord....	...	...	3½	...	...	...	...	...	...
60,000	10	Dublin United Tramways Co. (1896), Ltd., Ord.	6/-	7/-	12¼—13¼	13⅛	Jan. 29	4 18 3	Feb , Aug.	15	12⅞
59,987	10	Do. do. do. 6% Cum. Pref. ...	6/-	6/-	12½—13½	13½	Jan. 15	4 9 0	*Feb.*, July	14 13/16	12⅞
40,000	5	Hastings and District Electric Tramways 6% Cum. Pref. ...	...	...	4 5/16—4 9/16	90/-	Feb. 24	6 13 6	...	102	97
20,000	10	Imperial Tramways Ord.	8	10	10¾—11¼	11¼	Feb. 20	8 0 0	...	...	...
20,000	10	Do. 6% Cum. Pref.	6	6	10¼—10¾	10⅝	Feb. 20	5 11 9	...	...	...
30,000	5	Isle of Thanet Electric Trys. and Lighting Co. 5% Cum. Pref.	...	1/3	⅞—1⅛	20/-	Feb. 17	...	*Mar.*, Sept.	...	...
250,000	1	Kalgoorlie Electric Tramways	...	...	1/16—⅛	...	...	...	*May*	2½	1
28,723	10	Lanarkshire Tramways	...	5/6	9¾—10¼	10 1/16	Feb. 20	5 12 3	Feb , Aug.	3/32	1/16
594,188	1	Lisbon Electric Tramways Ord.	5	1/-	15/16—1 1/16	20/-	Feb. 15	4 14 3	*July.*	10½	9¾
425,553	1	Do. do. 6% Cum. Pref...	6	7½d.	15/16—1 1/16	...	...	5 13 0	*July.*	1 11/32	31/32
773,592£	Stk.	London General Omnibus Ord.	...	5%	37—42	38	Feb. 26	...	Mar., Sept.	1 5/16	⅞
25,000	10	Do. do. 5% Cum. Pref	5%	5/-	5¼—6¼	5¾	Feb. 19	...	Jan., July.	82	37
60,007	1	London Motor Omnibus Ord.	...	1/4	...	...	...	...	...	9½	4½
40,000	5	Do. do. 6% Cum. Pref.	...	2/2	...	...	...	...	...	...	...
74,000	6	London Road Car...	2/6	for '06	1¾—2¼	42/6	Feb. 22	...	Feb., Aug.	3¾	2 5/16
5,471	10	Do. 5% Cum. Pref.	...	5/7¼	6—8	6	Feb. 3	6 5 0	Feb., Aug.	...	...
31,000	4	London Street Tramways	...	2/-	⅜—½	...	...	...	*Mar.*	11/16	⅝
125,000	10	London United Tramways (1901), Ltd., 5% Cum. Pref. ...	3	2	7—8	7⅛	Feb. 27	6 5 0	*Jan.*, July.	9½	7⅜
22,900	5	Manx Electric Railway 5½% Cum Pref.	5½	2/9	4½—5	...	...	5 10 0	June, Dec.	5⅛	4⅝
314,016	1	Metropolitan Electric Tramways Def.	..	...	1/16—3/16	1/3	Jan. 28	Nil		3/16	1/16
500,000	1	Do. do. do. 5% Cum. Pref.	6d.	6d.	13/16—15/16	16/3	Feb. 19	5 6 9	*Feb.*, Aug.	1	¾
$7,500,000	$100	Mexico Tramways Gen. Con. 1st Mt. 5% Gold Bonds	...	5%	85—87%	85½	Feb. 27	5 17 9	Mar., Sept.	86	79
50,000	5	New General Traction 6% Cum. Pref.	...	...	¾—1¾	...	...	...	Jan., *July.*	1¾	¾
110,923	4½	North Metropolitan Tramways	...	1/-	⅛—⅜	4/4½	Jan. 20	...	...	...	...
5,000	10	Oldham, Ashton, and Hyde Electric Tramways Ord.	7/-	5/-	8¾—9	8 13/16	Feb. 18	6 13 6	...	...	...
5,000	10	Do. do. do. do. 5% Cum. Pref.	5%	5%	8—8¼	...	...	6 1 3	...	...	...
100,000	1	Perth (W.A.) Electric Tramways Ord.	5	1/-	9/16—11/16	...	...	7 5 6	*Mar.*	11/16	9/16
245,000	1	Potteries Electric Traction Ord.	4	for '07	¼—½	...	...	8 0 0	*Mar.*	⅜	⅜
245,000	1	Do. do. 5% Cum. Pref.	5	5	9/16—11/16	...	...	7 5 6	*Feb.*, Aug.	11/16	½
24,912	10	Provincial Tramways Ord.	3/-	5/-	4½—5	4⅞	Jan. 23	8 0 0	*Dec.*	5½	4½
10,000	10	Do. do. 6% Cum. Pref.	6/-	6/-	9½—10½	10 1/16	Feb. 11	5 14 3	June, *Dec.*	11	10¼
30,000	5	Rangoon Electric Tramways and Supply Co. 6% Cum. Pref.	...	3/-	5—5½	5⅜	Jan. 31	5 9 3	June, Dec.	5¾	5
85,000	$100	San Paulo Tramway, Light, and Power	...	$2½	121—125	121¾	Feb. 26	6 17 6	*Apr.*, Oct.	144½	101
6,343	10	Snowdon Mountain Tramroad Ord.	...	...	7—8	...	...	...	...	...	...
169,570	1	South Metropolitan Elec. Trys. & Lighting Co. 6% Cum. Pref.	6⅜d.	7½d.	15/16—1 1/16	17/6	Feb. 19	5 13 0	Feb., Aug.	1 3/32	⅞
3,900	5	Southport Tramways	4/-	...	3—3½	...	...	...	...	...	...
30,000	5	Star Omnibus 5½% Cum. Pref.	...	...	½—1	...	...	...	*Jan.*, July.	1½	¾
40,000	5	Yorkshire (West Riding) Electric Tramways Ord.	...	...	1—1½	...	..	...	*Mar.*	1 9/16	1
46,261	5	Do. do. do. do. 6% Cum. Pref....	...	...	3⅛—3⅝	72/6	Jan. 22	...	*Mar.*	4	3⅛

ELECTRIC RAILWAY SHARES.

1,853,610£	Stk.	Central London Ord. Stock	3	3	64—67	64½	Feb. 26	4 9 9	*Feb.*, Aug.	82¾	54½
1,480,000£	Stk.	City and South London Co's. Ord. Stock	2½	1¾	38—40	38¼	Feb. 21	5 6 3	*Feb.*, Aug.	50½	39
78,000	10	Great Northern and City Pref. Ord. 4%	11½d.	...	1½—1¾	27/6	Feb. 4	...	*Feb.*, Aug.	3⅞	1⅛
159,000	10	G.N., Piccadilly, and Brompton Ord.	4/-	...	5½—6½	6⅜	Feb. 26	6 3 3	*Feb*, Aug.	8	4
500,000	10	Liverpool Overhead Ord.	...	...	1⅜—1½	29/6	Feb. 27	1 13 6	*Feb.*, Aug.	2	1¼
1,412,263£	Stk.	Mersey Cons. Ord. Stock	...	...	2—4	...	...	Nil	*Feb.*, Aug.	7	2
5,732,062£	Stk.	Metropolitan Cons.	½	½	37—38	37½	Feb. 26	1 6 6	*Feb.*, Aug.	60¼	31½
3,235,000£	Stk.	Metropolitan District Ord.	...	...	10½—11½	10¾	Feb. 27	Nil	*Feb.*, Aug.	19¾	7¼
2,499,200£	...	Underground Electric Railways Co. of London, Ltd., 5% Profit-sharing Secured Notes.	5	ann.	42—45	...	...	11 2 3	*June*, Dec.	89	34

* Date of final payment is given in italics.

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TRAMWAY AND ELECTRIC RAILWAY LEGISLATION.

During February a start was made with the material stages of tramway bills in Parliament. The bills promoted by companies, as usual, have been hampered by objections under the standing orders.

SECOND READINGS.—In the House of Lords.—February 10: Keighley Corporation, Merthyr Tydfil Corporation. February 20: Metropolitan District Railway, Great Northern, Piccadilly and Brompton Railway. February 27: London County Council (Tramways and Improvements).

In the House of Commons.—February 10: Burnley Corporation, Doncaster Corporation, Leeds Corporation, Rochdale Corporation. February 17: Nottinghamshire and Derbyshire Tramways. February 18: Macclesfield and District Tramways (Abandonment), Wolverhampton Corporation.

BELFAST CORPORATION.—This bill came on for second reading in the House of Commons on February 27. It proposed to confirm an agreement for the purchase by the Corporation of the Cavehill and Whitewell Tramways for £60,000. Mr. Devlin, Nationalist member for West Belfast, moved the rejection of the bill. The tramway company, he stated, was associated with the British Electric Traction Company, and the capital was greatly inflated. It was a single track tramway 3¼ miles long, and the capital worked out at over £16,000 per mile. The price of £60,000 proposed to be paid was exorbitant, and it was to be extorted from the ratepayers of Belfast. He would propose, as a compromise, that the price should be £40,000, including the grounds. That was the valuation put on the undertaking by the Belfast city surveyor and the Belfast tramway manager. He ridiculed the view that it was necessary to make the purchase to prevent the tramway company from promoting a bill for securing running powers into the centre of Belfast. The tramways would be useless after they were purchased until a further £40,000 was spent on doubling the track. The poll of the ratepayers which resulted in a majority in favour of the bill had not been taken on the merits, but on a party basis. Mr. G. W. Wolff, Unionist member for East Belfast, in supporting the bill, said that the opposition to it came chiefly from the owners of public-houses in Belfast who were mostly Roman Catholics and Nationalists. The poll of the ratepayers had been properly and fairly conducted, and it resulted in favour of the measure by a majority of two to one. Whatever the price to be paid, the policy had been fully endorsed by the ratepayers. In the course of further discussion, Mr. Emmott, Chairman of Ways and Means, said that it would be a most unusual course to throw out the bill at this stage. The matter should go before a Committee, and the question was what sort of a Committee it should be. The opponents of the bill would not have a *locus standi* before a Committee, so that in the ordinary course the measure would go to the Unopposed Bills Committee, which was not a very satisfactory tribunal for this purpose. He would recommend that the bill should be read a second time, and be referred to an opposed bills committee. Even in that case the opponents could not be heard, but a resolution could be passed that petitioners presenting petitions within so many days of the meeting of the Committee should be heard. If it would lead to an agreement, he would be ready to move such a resolution after the second reading. The motion for the rejection of the bill was carried by 176 votes against 130, the result being received with Nationalist and Radical cheers. The debate lasted for over two hours, nearly half of which time had been taken up by Mr. Devlin.

HIGHGATE HILL TRAMWAYS.—A point of considerable importance to tramway promoters and to local authorities was decided by Mr. Campion, one of the Parliamentary examiners of private bills, when the Highgate Hill Tramways Bill came before him. The bill, among other things, proposes to change the system of traction on the company's tramways from cable to electric, to alter the gauge from 3 ft. 6 in. to 4 ft. 8½ in., and with the consent of the Board of Trade to substitute double for single track. Agents for Middlesex County Council, London County Council, and Hornsey Borough Council appeared before the examiner, and contended that an alteration of gauge of a tramway constituted a new tramway, that, therefore, the bill was one of the second class, and that the consents of the local authorities under Parliamentary standing orders, as well as various notices, were required. For the promoters, the opposite view was argued. The examiner said he could not hold that the mere alteration of gauge constituted a new tramway. In regard to the power to double the lines, it could only be done with the sanction of the Board of Trade, and the frontagers were absolutely protected by the clause in the bill referred to. He therefore decided that the bill was a first and not a second-class bill, and that the standing order in regard to the posting of street notices, deposit of plans, consents of local and road authorities, deposit of estimates, and money deposit did not apply, and he found the standing orders complied with. This decision is to the same effect as one on the City of Birmingham Tramways Bill in 1901, in which it was held that changing from horse to electric traction, and the necessary alterations and equipment, therefore, did not constitute a new tramway.

LOCAL AUTHORITIES AND COMPANIES' BILLS.—In the case of three tramway bills promoted by companies which came before the Examiners on February 24, it was certified that the standing orders of Parliament had not been complied with owing to local authorities concerned having refused to give their consent to the measures. The West London, Barnes and Richmond Tramways Bill was opposed by London County Council, Richmond Town Council, and Barnes Urban District Council. Opposition to the Croydon and Southern Districts Tramways Bill came from local authorities to the south of Croydon In the case of the London United Tramways Bill, Brentford District Council neither consented nor opposed, and Middlesex and Surrey County Councils would only consent on condition that the company should pay £2,250 per annum and one-third of the cost of keeping Kew Bridge (across which the proposed tramway would run) in repair.

LONDON AND WINDSOR MOTOR ROADS.—On February 4, Mr. Campion, one of the examiners of private bills at Westminster, gave his decision in reference to objections on standing orders raised by the London United Tramways Company to the London and Windsor Motor Roads, Tram Roads, and Tramways Bill. He said that the bill raised a novel proposition. While there was no real physical difference between a motor road and an ordinary road, yet there was a difference in the use to which it was intended the road should be put. The novelty was in the attempt to combine in one scheme two works belonging to different categories, *i.e.*, roads and tramroads, to each of which different standing orders applied. It might be that they were at the beginning of a new chapter of industrial activity in regard to motor roads, and it was very important that this should be considered by the authorities. Further questions of public safety, and so on, might be raised, on which different views might be taken, which rendered it all the more important that the fullest information should be supplied to persons locally interested in the methods by which the promotors proposed to carry out their scheme. He did not think the centre line on the deposited plans did convey sufficient information of the intentions of the promotors to construct a motor road with a tram line on either side. He considered it his duty to report the bill for the further consideration of the Standing Orders Committee. On February 6, when the bill was again before the Examiner, it was stated that the promoters intended to drop the proposal in it for a tramway in Windsor, close to the Castle.

LONDON COUNTY COUNCIL (TRAMWAYS AND IMPROVEMENTS).—This bill came before the Standing Orders Committee of the House of Lords on February 26, on a report from the Examiners of non-compliance with the standing orders. The Committee decided that the bill should be allowed to proceed, provided that the powers to construct tramways Nos. 3, 4, and 5 were struck out. These were to be single-track lines measuring in all 1 mile 36 chains in length, running from Essex Road, Islington, along Englefield Road and Stamford Road to Kingsland Road, Hackney, and from Kingsland High Street along Ridley Road and Dalston Lane. Power was sought to work the lines on the trolley system.

ROCHDALE CORPORATION.—This measure has been referred to the Unopposed Bills Committee of the House of Commons.

LEICESTER CORPORATION TRAMWAYS.

The annual report for 1907 by Mr. A. F. Lucas, Leicester tramways manager, shows that the total revenue was £116,846, being an increase of £318 over the previous year. The working expenses were £70,888, an increase of £1,947, due to increases in wages, maintenance, and power expenses. Out of the gross surplus, £35,872 goes to debt charges, leaving a net balance of £10,539. The number of passengers was 27,417,227, and the miles run numbered 3,334,924. At the meeting of Leicester Town Council at which the report was presented, Mr. Flint, in reviewing the figures, said that the Tramways Committee had decided that the net balance of £10,539 should be carried to the reserve fund, which would then stand at £53,145. To show what progress had been made since the Corporation took over the tramways, he would compare the year 1901 with 1907. In 1901 the number of car miles was 868,000, last year the figure was 3,334,924 miles; 10,090,000 passengers were carried in 1901, while in 1907 the numbers were 27,417,227. The traffic revenue in 1901 was £43,777; last year it was £144,667 19s. 4d. Last year they ran four times as many miles as seven years ago, and carried nearly three times as many passengers. During the year a parcel service was commenced, and in time he believed this would prove a boon. The wages and conditions under which their men worked would bear favourable comparison with the wages and conditions of any Corporation in the country, and they were higher and better than any private tramway company in the country. While their working expenses and upkeep expenses were as low as the average in the country, their earning power was considerable less, owing to the fact that they gave long rides for a penny. If their earning power had been as high as other towns they would have had from £6,000 to £10,000 more. The average earning power in Leicester was less than 8d. per car mile.

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FINANCIAL REPORTS AND COMPANY MEETINGS.

Walter Scott, Limited.—The directors have declared an interim dividend of 6d. per share on the ordinary shares for the past half-year.

Corringham Light Railways.—The profits for the past year were £1,305, and £76 was brought forward. A dividend of 7½ per cent. is proposed, carrying forward £127.

W. T. Henley's Telegraph Works Company.—The directors have declared a dividend on the ordinary shares of 15 per cent., less income-tax, including the interim dividend of 5 per cent. paid September 2 last.

Bolckow, Vaughan, and Company.—The directors have decided to pay on the ordinary shares an interim dividend for the half-year ended December 31 last at the rate of 5 per cent. per annum, free of income-tax.

Chatham and District Light Railways.—The directors have declared a dividend for the year ended December 31 last of 3 per cent. on the preference shares. A sum of £3,000 is transferred to reserve for depreciation, and £347 is carried forward.

Lancashire United Tramways.—The accounts for 1907 show a profit of £12,789, and after payment of the prior lien debenture stock interest there is a balance of £289. This amount, together with the credit balance brought forward, has been written off the loss on the sale of motor omnibuses.

Burton and Ashby Tramway.—The Midland Railway Company, in their half-yearly report, state that the expenditure of the Burton and Ashby light railway for 1907 amounted to £6,611, as compared with £5,734 in 1906. The receipts amounted to £8,569 in 1907, compared with £8,211 in 1906, while the car mileage was 182,176, as compared with 165,420 in 1906.

Walsall Tramways.—The total revenue for 1907 was £27,356, and the working expenses £15,265. After paying debt charges, there is a surplus of £4,306, which is added to the reserve fund, bringing it up to £15,292. The number of passengers was 4,860,764, the traffic revenue per car mile was 10·63d., and the working expense per car mile was 6·05d.

The Loss on Lancaster Tramways.—Lancaster Town Council have discussed at length the question of the loss on the working of the tramways Some councillors strongly urged that the matter should be faced, and the tramways be either extended, disposed of, or given up. Other members protested against the idea of giving control of the streets to outside bodies, and it was suggested that the Council should purchase the horse trams, but this was repudiated. Mr. Alderman Bell said the annual loss was equivalent to a 4d. rate. No definite action was, however, taken.

Aberdeen Suburban Tramways Company.—The report of this company for the half-year ending January 31, 1908, shows that the profit earned for the half-year amounts to £887, and, including the amount carried forward from the last half-year, there is a balance of £1,587 at the credit of profit and loss account. The directors recommend that this sum should be carried forward, pending a decision in regard to some matters referred to in the last report. The directors state that they have elected Mr. James Mearns, of Aberdeen, as a director of the company, in the place of the late Mr. John Morgan.

City of Buenos Ayres Tramways Company (1904) Limited.—The report for the year ended December 31 last states that the annuity payable by the Anglo-Argentine Tramways Company has been received. The net revenue for the year has amounted to £65,744. Interim dividends have been paid for the nine months ended September 30, 1907, leaving a balance of £19,244. The directors recommend that a balance dividend of 1s. 3d. per share (making 5s. per share) be paid for the year ended December 31, 1907, that the sum of £3,600 be transferred to general amortisation fund, and that the balance of £144 be carried forward.

Blackpool and Fleetwood Tramroad.—The accounts for the half-year ended December 31 last show that the total revenue was £23,906, compared with £24,536 in the corresponding half of 1906. The expenses amounted to £10,581, as against £12,385, so that the credit balance was £13,325, against £12,152. After adding the balance forward and deducting the debenture interest, the net profit is £12,538, out of which the directors recommend a dividend at the rate of 9 per cent. per annum, writing off £2,500 to depreciation reserve and £879 to general reserve, leaving £2,409 to be carried forward. The number of passengers was 1,799,442, and the number of car miles run was 394,489.

Montreal Street Railway Company.—This company has issued £460,000 of 4½ per cent. sterling debentures. The prospectus stated that the authorised capital of the company is $18,000,000, of which $9,000,000 has been issued, and is fully paid up. The system consists of 135 miles, and, in addition, the company owns all the other electric railways in the island of Montreal, comprising 73½ miles. The company has paid a 10 per cent. dividend on its stock since 1898, and 8 per cent. prior to that. The present issue is for the purpose of redeeming a first series of 5 per cent. bonds amounting to $292,000, the repayment of outstanding loans, and for construction expenses during the current year.

Year's Results in Liverpool.—At a meeting of Liverpool Town Council on February 5, a summary of the financial results of the operation of the tramways during 1907 was submitted. The total receipts amounted to £583,057, and the total expenditure to £398,734. The balance carried to net revenue account was £184,323 8s. 10d. Other items of income, chiefly interest, raised the total to £199,632. This was disposed of by the payment of £53,060 interest on loans; £5,891 rent on leased lines; £54,276 payments to sinking funds; £3,026 repayment of loans; £27,793 contribution in aid of general rate; and £55,586 payments to reserve, renewal, and depreciation account.

Charing Cross, Euston, and Hampstead Railway.—The report for the past half-year states that the gross receipts were £74,328, and the working expenditure (including rates and taxes) has been £61,353. The following is the number of pasengers carried since the opening of the railway, including estimated journeys by season-ticket holders: Eight days to June 30, 1907, 421,466; half-year to December 31, 1907, 9,881,357. The amount required to meet interest, rents, and wayleaves is £18,728, and this is provided by the balance from revenue account, by credit interest, and by £5,627 paid by the Underground Electric Railways Company of London. The number of train miles run during the half-year was 883,036, equal to 2,880,715 car miles.

Baker Street and Waterloo Railway.—For the half-year ended December 31 last, the gross receipts were £69,249, which shows an increase of £24,669, or 55·3 per cent. on the corresponding half of 1906. The working expenditure (including rates and taxes) has been £43,925. After providing for interest and rents, and crediting to net revenue account £2,440 receivable from the Underground Electric Railways Company of London, under their guarantee agreement, there remains a balance of £17,670, and the directors recommend that dividends at the rate of 4 per cent. per annum be declared on the preference shares and of 3 per cent. per annum on the ordinary shares other than those held by the Underground Company. The number of passengers (including estimated journeys by season-ticket holders) was 10,662,876, against 6,799,895 in the corresponding half of 1906. The train mileage during the half-year was 523,239, equal to 1,633,406 car miles.

Yorkshire (West Riding) Tramways Company.—The report for the past year states that after providing for all expenses there is a net income of £27,377. Adding the balance brought forward, £4,443, the available profit is £31,820. This has been dealt with as follows: Debenture interest on 4½ per cent. stock, £11,756; debenture interest on 6 per cent. bonds, £744; sundry reserves, £9,856; carried forward, £9,463. The number of passengers amounted to 8,627,247, and the miles run to 1,758,669, as against 6,169,148 and 1,414,767 respectively for the previous year. The increase of passengers is chiefly due to the completion of the Normanton and Pontefract section, but a satisfactory expansion of traffic is also shown on the old routes.

Liverpool Overhead Railway.—The directors' report for the half-year ended December 31 last shows that the gross receipts amounted to £41,136. There has been a small increase in working expenses, which amount to £32,154, due to the additional cost of coa and stores. The number of passengers carried during the half-year aggregated 5,804,629, an increase of 381,234. After payment of debenture interest, and taking in the balance from the previous half-year, a sum of £9,104 is available for dividends. From this amount the directors recommend that 5 per cent. dividend on the preference shares should be declared, amounting to £3,675, and a dividend of ½ per cent. on the ordinary shares, requiring £1,250. This leaves a balance of £4,178 to be carried forward.

Great Northern, Piccadilly, and Brompton Railway.—The report for the half-year ended December 31 last shows that the gross receipts amounted to £119,271, and the working expenditure has been £70,752. After providing for interest and rents there remains £7,114 available for dividend, and the directors recommend that a dividend at the rate of 4 per cent. per annum, payable on February 25, 1908, be declared on the ordinary shares other than those held by the Underground Company or their nominees, who have consented thereto. The number of passengers carried, including estimated journeys by season-ticket holders, was 13,914,779, against 11,953,759 in the preceding half-year. The receipts during the four weeks of January in this year show an increase of 55½ per cent. on the receipts for the corresponding weeks in 1907. The train mileage during the half-year was 952,571, equal to 3,206,269 car miles.

Hastings Tramways.—The report of the Hastings and District Electric Tramways Company for 1907 states that the revenue account of the Hastings Tramways Company shows a credit balance of £24,072, which has been handed over by way of dividend on its shares, which are all owned by this company. The revenue account of this company, therefore, shows receipts aggregating £24,099, or, after deducting its administration expenses, £22,206; adding to this £300 for interest

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earned and £733 brought forward, and deducting £9,472 debenture stock interest paid, there remains a balance of £13,767. From this has been paid during the year by way of interim dividend on the preference shares the sum of £4,000, being at the rate of 4 per cent. per annum, and the directors now propose to pay a further sum of £8,000, being at the rate of 8 per cent. per annum, making the full 6 per cent. for the year 1907, and to carry forward £1,767.

Lanarkshire Tramways Company.—The report for the half-year ended December 31 last shows a considerable increase in revenue, even after allowing for the fact that a greater mileage was open, and the dividend is ½ per cent. per annum higher than for the first half of the year. The main results are: Revenue, £34,926; expenses, £20,732, leaving £14,194, less interest on debentures, £608; interest on loans, £306; contributions payable to local authorities, £620; amounts written off, £2,589; add balance brought forward from June 30, 1907, £5,182, leaving 15,252. Of this amount £5,500 has been placed to reserve for depreciation, and the directors recommend that the balance be disposed of as follows: £8,616 to dividend at the rate of 6 per cent. per annum, £240 to directors, £894 to revenue new account. The directors propose to proceed at once with the construction of two short extensions. To meet the immediate requirements for capital expendture the shareholders are now invited to subscribe for £20,770 additional share capital at par.

Imperial Tramways Company.—The report of the directors for the year ended December 31 last, states that the gross receipts of the Middlesbrough, Stockton, and Thornaby Electric Tramways amounted to £54,747, showing a decrease of £387 on the receipts for the previous year, although the number of passengers increased by 26,885. After placing £2,500 to the reserve fund for renewals (bringing the total of that fund up to £15,900), the net profit for the year is £16,884. Regarding the Corris Railway, the working expenses have been reduced by £303; but, after payment of the debenture interest, the revenue account shows an adverse balance amounting to £63, which is carried forward to the next account. The revenue derived during the year from the London United Tramways, Limited, is £21,111, being the same amount as for the corresponding period. The company's net revenue account for the year shows an available balance of £41,573, and after payment of interest on the debenture stock for the whole year, and interim dividends on the preference and ordinary shares in respect of the half-year to June 30 last, amounting together to £26,125, it is proposed to appropriate the balance as follows: Dividend at 6 per cent. per annum on the preference capital (paid on January 1 last), £5,700; final dividend at 10 per cent. per annum (making 9 per cent. for the year) on the ordinary capital (less income-tax), £9,500; and to carry forward to the next account £248. The reserve funds now amount to £128,771.

Metropolitan District Railway.—The report for the half-year ended December 31 last shows that the receipts were £224,463, against £215,846 in the corresponding half of 1906, and the working expenses £156,069, against £155,719. Rents, etc., bring the gross surplus up to £96,882. After paying prior charges, and dividend on the guaranteed stock at the rate of 1¾ per cent. per annum, there is a debit balance of £45,328. The dividend deficiency on the 4 per cent. guaranteed stock stands at £212,379. The number of passengers was 25,808,732, against 25,789,127, and the train mileage was 1,679,762, against 1,624,300. During the half-year the directors have given much consideration to the financial position of the company. They came to the conclusion that the best course was to submit a statement of the position to the debenture stockholders, and to deposit a bill in Parliament to enable requisite funds to be raised by the issue of prior lien debenture stock ranking next after the rent-charge stocks. The directors believe that if authority is obtained to issue the proposed prior lien stock the finances of the company will be placed on a safe footing, the train services will be maintained in their present satisfactory condition, and will attract a constantly-increasing traffic, and the net revenue will shortly be sufficient to cover the full interest on all the existing rent-charge and debenture stocks of the company, as well as the interest on the proposed new stock.—At the meeting of the company on February 12, at which the report was adopted, Sir George Gibb, the chairman, dwelt on the increasing traffic and the more frequent services of trains now given.

Tyneside Tramways and Tramroads Company.—The directors' report for the half-year ended December 31, 1907, presented at the meeting of the company on February 10, shows that the receipts exceeded the expenses by £3,785, which, with the balance brought forward of £600, makes a total surplus of £4,385. After deducting interest on mortgages, loans, etc, there remains a balance of £2,968, which was appropriated as follows: Dividend on preference shares at 5 per cent. per annum (less income-tax), £272; dividend on the ordinary shares at the rate of 2½ per cent. per annum (less income-tax), £1,674 (the dividend on the ordinary shares last year was at the rate of 2 per cent.); reserve for renewals, depreciation, etc., £600, increasing the amount to £4,600; balance carried forward to next half year, £422. The directors report that Mr. J. H. Noble, owing to other business engagements, has resigned his seat on the board. The following statement shows the progress of the undertaking since the beginning of traffic in 1903:

	1903.	1904.	1905.	1906.	1907.
Car miles	518,502	654,116	666,820	674,694	679,692
Passengers carried ...	2,641,915	3,325,277	3,809,432	4,247,955	4,703,459
Total traffic receipts...	£16 362	£19,728	£20,963	£22,966	£24,068
Gross profit	£3,104	£4,842	£5,488	£7,792	£8,262

The paid-up share capital now amounts to £152,704, and there are in addition £40,000 5 per cent. mortgage debentures.

Bristol Tramways and Carriage Company.—For the year ended December 31 last the directors report that the gross receipts amount to £263,689, and the working and general expenses to £178,342, leaving a net revenue of £85,347. The following amounts have already been distributed, viz.: Interest on 4 per cent. mortgage debenture stock, on deposits and bankers' interest, £14,889; dividend on 4 per cent. preference shares, £19,000: interim dividend at the rate of 8½ per cent. per aunum (subject to income-tax) for the half-year ended June 30, £20,187—£54,076. It is proposed to appropriate the balance as follows: Final dividend for half-year at the rate of 9½ per cent. per annum (subject to income-tax), £22,562; and addition to reserve fund for contingencies and renewals, £8,708. With the addition now proposed the reserve fund will be £188,534. The number of passengers was 46,585,050, as compared with 46,902,257 in the previous year. Among improvements effected in the undertaking last year were the building of a commodious electric car depôt at Eastville, a new motor omnibus depôt at Filton, and the conversion of the Colston Street depôt so as to concentrate there the whole work of the outdoor electrical department dealing with the cables and overhead line. Similarly the engineering and permanent way departments have been brought together by the provision of comprehensive offices, stores and workshops on the site formerly occupied by the Whitson Street depôt and adjacent properties. Substantial progress has been made with the additions and alterations to the company's central power-station at Counterslip, and when completed, within the next three months, the capacity of the station will be increased by 50 per cent., and be more than sufficient for the working of the whole of the authorised extensions. The directors are now able to proceed with the construction of the other extensions authorised at the same time as the Filton line already opened. The next section to be taken in hand will be that to Westbury-on-Trym, which will be constructed during the ensuing summer.

Dublin United Tramways Company.—Some interesting points were brought out by Mr. Wm. Murphy, the chairman, at the meeting of this company in Dublin on February 4, at which the directors' report, which has already been published, was adopted. Mr. Murphy said that the International Exhibition had favourably affected the receipts of the company. The fortunes of the Exhibition were in a large measure dependent on the ability of the tramways to carry passengers to and from its gates, and the tramway staff and appliances never failed to meet the heaviest demands. He had observed the methods of dealing with passenger traffic during rush hours by railways and tramways elsewhere, and he had never seen anything better done than the way in which the Exhibition traffic was handled. At the closing hour the apparently inexhaustible supply of cars was filled and despatched without the least confusion, and with the greatest comfort and convenience to the public. After reviewing the details of the accounts, Mr. Murphy made a comparison between the Dublin tramway system and some of the large municipal systems in Britain. In Glasgow there was one mile of tramways to every 11,949 of the population; in Leeds, one mile to 9,066; in Liverpool, one mile to 14,434; in Manchester, one mile to 8,355; while in Dublin there was one mile to serve every 7,662 of the inhabitants. This generous provision of tramway mileage in Dublin, serving an attenuated population, when compared to the other cities named, was reflected in the number of passengers per car mile and the receipts per car mile, which were, respectively:

Passengers carried per car mile:	
Glasgow	11·02
Leeds	9·92
Liverpool	9·90
Manchester	9·23
Dublin	6·96
And the receipts per car mile:	
Glasgow	10·31d.
Leeds	10·56d.
Liverpool	11·22d.
Manchester	11·02d.
Dublin	8·60d.

Dublin was better served with tramway accommodation than any of the cities he had named, which he had selected for comparison, as they stood at the front of municipal tramway enterprise in Great Britain. As to further extensions of the Dublin system, the remaining term of their concession (29 years) held out no inducement for further enterprise, but had a deterrent effect on the development of tramway facilities.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track). Mls.	Chs.	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Sinking Fund and Loans Repaid.	Depreciation, Renewal, and Reserve Funds.	Income. Traffic.	Other.	Total.
Aberdeen	May 31, 1907	Dec., 1899	E.	27	60	350.000	317,140	32.860	345.025	12,433	299,970	17.169	40,155	65,853	834	66.687
Ayr	May 15, 1907	Sept., 1901	,,	9	52	105.000	70,000	35,000	79.934	8.283	62,752	4.820	14,954	14.672	541	15.213
Birmingham	Mar. 31, 1907	Jan., 1904	,,	..		1,079.687	743,037	336.650	850,916	...	732,016	11,021	25,932	132,662	3,762	136.424
Blackburn	Mar. 25, 1907	Mar., 1899	,,	23	64	400,337	328.087	72.250	330.563	13.469	236,042	81.617	...	52.811	2.141	54.952
Blackpool	Mar. 31, 1907	June, 1899	,,	17 *3	30 69	424,490	281,390	143,100	281,390	16,195	281,390	54,624	13,236	50,554	952	51.506
Bolton	Mar. 31 1907	Dec., 1899	,,	42	42	632.760	528,027	104,733	471.760	11,093	377,482	71.801	48.622	110,935	359	111.294
Bradford	Mar. 31, 1907	July, 1898	,,	87 *9	67 6	1,192,626	902,878	289,748	903.368	9,321	756,992	200,046	38,024	227,495	4,612	232.107
Brighton	Mar. 31, 1907	Nov., 1901	,,	17	15	279.070	274,070	5,000	274.905	15.994	257.186	20,885	3.165	48,898	1.755	50.653
Burnley	Mar. 31, 1907	Dec., 1901	,,	14 *5	20 32	278,892	252,896	25,996	185,325	13,005	175,331	23,012	20,793	62,076	728	62,804
Burton-on-Trent	Mar. 31, 1907	Aug., 1903	,,	9	70	100.073	88.336	11.737	92.971	9.415	83.746	...	...	15,102	430	15.532
Bury	Mar. 31, 1907	June, 1903	,,	17 *9	50 21	407,800	225,525	182,275	242,466	13,757	223,500	8,246	5,904	50,518	131	50.649
Chester	Mar. 25, 1907	April, 1903	,,	6	35	92.991	73.991	19,000	77.662	12.064	70.221	5.141	332	10.274	329	10.603
Chesterfield	Mar 31, 1907	Dec., 1904	,,	5	68	95,000	68.528	26,472	68.529	11,714	65.000	2,557	...	10,989	503	11,492
Colchester	Mar. 31, 1907	July, 1904	,,	7	75	70.748	68,755	1,993	68.847	8,673	65.858	4,214	...	10,787	580	11.367
Croydon	Mar. 31, 1907	June, 1906	,,	19	44	336.611	254,010	82,601	270.043	13,813	224,234	35,276	..	61,091	975	62.066
Darlington	Mar. 31, 1907	June, 1904	,,	8	71	107,500	75,165	32,335	76,293	8,584	69,425	5.540	...	10,820	323	11,143
Darwen	Mar. 31, 1907	Oct., 1900	,,	7	13	93.400	85,400	8,000	85.436	11,928	73,879	13,658	1,150	13,327	681	14.008
Derby	Mar. 31, 1907	July, 1904	,,	E. 15 H.	1	...	...	...	175,247	...	159,722	15,525	...	E 37,558	871	38,429
						...	...	...	...	...		...	...	H 4.184	147	4.331
Doncaster	Mar. 31, 1907	June, 1902	,,	10	42	92.500	84,200	8.300	84.735	8.051	79.200	5.727	...	12.030	337	12.367
Douglas (I.O.M.)	Mar. 31, 1907	..	H. C.	3 2	40 60	54,020	54,020	...	55,514	8,882	49,166	4,889	3,000	20,220	1,314	21,534
Dundee	May 15, 1907	July, 1900	E.	24	41	...	...	...	312,886	12,746	258,824	47,613	26,780	56.921	751	57,672
East Ham	Mar. 31, 1907	June, 1901	,,	12	61	160,442	160,133	309	164,064	12,855	146,323	20,775	3,442	46,435	653	47.088
Gloucester	Mar. 31, 1907	April, 1904	,,	12 *2	41 39	151,000	126,000	25,000	127,326	10,186	123,333	3,993	...	14,192	841	15.033
Halifax	Mar. 31, 1907	June, 1898	,,	52	26	663,751	393,764	269.987	393.280	7,516	333,287	48,149	8,544	75,986	1,341	77.327
Ilford	Mar. 31, 1907	Mar., 1903	,,	11	28	142,603	142,396	207	142.396	12.546	129.549	13,054	6,532	24,478	912	25.390
Ipswich	Mar. 31, 1907	Nov., 1903	,,	14	70	116.471	110.000	6.471	114.334	7,687	106.098	4,674	...	21,262	780	22,042
Keighley	June 30. 1907	Oct., 1904	,,	6	9	50.934	46.004	4.930	46.004	7,526	39.891	6,827	1,641	8,019	222	8.241
Kilmarnock	May 15. 1907	Dec., 1904	,,	5	42	65,000	54.615	10.385	54.078	9.788	54.615	151	...	8,246	357	8,603
Kirkcaldy	May 15 1907	Feb., 1903	,,	7	62	200,000	88,693	111.307	89.404	11,499	83,750	4,943	1,267	13,230	473	13,703
Lancaster	Mar. 25. 1907	Jan., 1903	,,	4	65	60,000	51.550	8,450	41.339	8,590	46.250	5,651	...	5,360	119	5.479
Leith	May 15, 1907	Aug., 1905	,,	11	76	225,000	171,345	53,655	179.796	15,046	179.062	6,873	...	26,380	643	27.033
Lincoln	Mar. 31, 1907	Nov., 1905	2	2	77	98,519	43,072	55.447	39.231	13,243	48,061	2,819	...	5,741	104	5,845
Liverpool	Dec. 31, 1906	Nov., 1898	E.	104	0	2,442,600	2,044,775	397,825	1,901,997	18,288	1,604,435	503,941	238,354	563,777	7,439	571.216
Lowestoft	Sep. 30, 1907	July, 1903	,,	5	79	129.230	79,231	49,999	79,231	13,233	75.135	5,076	...	10,937	349	11.286
Maidstone	Mar. 31. 1907	July, 1904	,,	2	23	25,000	25.000	...	26,255	11,477	25,005	1,250	2,000	5,650	241	5.891
Manchester	Mar. 31, 1907	June, 1901	,,	111 *43 †14	6 57 54	1,875,015	1,558,669	316,346	1,725,845	15,538	1,436,184	144,197	320,028	712,976	6,697	719,673
Nelson	Mar. 31. 1907	Feb., 1903	,,	3	69	38,000	35,662	2,338	35,662	9.233	33,291	2,371	...	7,264	55	7.319
Newport (Mon.)	Mar. 31, 1907	April, 1903	,,	14	40	264,500	183,819	74,681	199,424	13,753	180,461	18,003	1,046	32,547	652	33,199
Nottingham	Mar. 31, 1907	Jan., 1901	,,	35	58	730,300	581,734	148,566	581,734	16.284	473,128	116,340	53,668	137,998	1,995	139.993
Oldham	Mar. 25, 1907	May, 1902	,,	27 *8	20 31	507,769	439,547	68,222	440,422	16,162	380,354	94,643	6,119	92,763	1,315	94,078
Perth	May 15. 1907	Nov., 1905	,,	8	40	70,000	73,400	...	74,879	8,809	70,450	3,710	...	7,985	411	8,396
Plymouth	Mar. 31, 1907	Sept., 1899	,,	15	0	182,856	174,906	7,950	215,986	14,399	132,872	45,355	29,126	31,256	10	31,266
Rochdale	Mar. 31, 1907	May, 1902	,,	24 *5	45 26	354,491	345,000	9,491	343,246	13,974	345,000	16,231	...	53,830	308	54,138
Rotherham	Mar. 31, 1907	Jan., 1903	,,	10	0	228,550	112,500	116,050	123,914	12,391	104,040	8,517	9,181	26,917	819	27,736
Salford	Mar. 31, 1907	Oct., 1901	,,	36 *38	40 20	1,192,246	669,583	522,663	574,853	15,749	626,609	125,701	46,146	232,551	...	232,551
Southampton	Mar. 31, 1907	Jan., 1900	,,	16	22	202,539	172,397	30,142	200,183	12,300	164,242	35,659	690	49,636	1,368	51.004
Southport	Mar. 31, 1907	July, 1900	,,	10 *8	61 78	292,000	196,500	95,500	195,412	9,930	157,230	39,270	6,773	18,176	307	18.483
South Shields	Mar. 31, 1907	Mar., 1906	,,	10	21	252,171	134,061	118,110	155,422	15,145	133,360	7,653	2,531	23,992	46	24.038
Stalyb'ge, Hyde, Mossley, & D'k'f'd	Mar 31, 1907	May, 1904	,,	27	57	325,270	259,470	65,800	258,177	9,318	244,028	15,442	...	38,766	39	38.805
Sunderland	Mar. 31, 1907	Aug., 1900	,,	19	40	304,086	294,461	9,625	289,691	14,825	233,485	52,094	...	72,054	342	72,396
Wallasey	Mar. 31, 1907	Mar., 1902	,,	12	55	140,436	138,150	2,286	138,917	10,950	127,918	10,723	18,592	42,254	630	42,884
Walsall	Dec. 31, 1906	Dec., 1902	,,	15 *2	2 5	188,144	151,000	37,144	142,947	8,366	145,900	6,162	...	26,400	546	26,946
Warrington	Mar. 31, 1907	April, 1902	,,	9	52	128,050	100,446	27,604	101,615	10,530	89,721	10,831	1,530	19.204	336	19,540
West Ham	Mar. 31, 1907	Feb., 1904	,,	26	35	509,119	353,753	155,366	547,989	20,728	531,494	11,822	19,548	116,793	2,982	119.775
Wigan	Mar. 31. 1907	April, 1901	,,	24	70	461,570	459,670	1,900	515,212	20,712	465,985	55,168	...	61,101	1,368	62,469
Wolverhampton	Mar. 31, 1907	April, 1902	2	20 *4	0 40	279,228	245,861	33,367	254,606	12,730	227,359	17,260 Motor Omnibuses	18,051	43,183 2,375	640 45	43,823 2,420
Yarmouth (Gt.)	Mar. 31. 1907	June, 1902	E.	12	4	144,500	110,000	34,500	110,363	9,159	101,791	5,424	1,197	21,390	512	21,902

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast	Mar. 31, 1907	Nov., 1905	E.	73	18	1,225,448	1,060,000	165,448	1,115,784	15,232	1,060,000	22.256	13,000	177,832	3,307	181.139
Bexley	Mar. 31, 1907	Oct., 1903	,,	6	73	98,259	96,984	1,275	94,858	13,723	90,854	6,130	...	11,419	1,569	12.988
Birkenhead	Mar. 31, 1907	Feb., 1901	,,	23	79	366,266	357,854	8,412	357,991	14,914	306,891	50,964	11,025	54,252	1,156	55.408
Bournemouth	Mar. 31, 1907	July, 1902	,,	34 *10	35 0	381,554	381,554	...	401,668	11,664	368,221	35,518	24,999	83,663	360	84,023
Cardiff	Mar. 31, 1907	May, 1902	,,	36	50	802,039	732,383	69,656	767,109	20,948	683,467	73,808	9,277	106,551	12,564	119,115
Glasgow	May 31, 1907	Oct., 1898	,,	165 *10	47 55	3,100,000	2,227,353	872,647	3,104,061	18,746	1,679,974	547,379	1,122,104	887,381	8,461	895,842
Huddersfield	Mar. 31, 1907	Feb., 1901	,,	33 *3	0 20	646,284	398,957	247,327	412,902	12,512	325,819	82,507	44,360	78,115	3,081	81.196
Hull	Mar. 31, 1907	July, 1899	,,	27	15	488,673	436,543	52,130	436,543	16,057	436,543	67,357	74,775	121,186	...	121,186
Leeds	Mar. 31, 1907	Aug., 1897	,,	96	50	1,340,374	1,340,374	...	1,303,815	13,494	1,167,263	213,248	33,270	323,913	3,891	327.794
Leicester	Dec. 31. 1906	May, 1904	,,	37	0	734,838	678,805	56,033	677,829	18,320	651,645	46,672	41,448	114,752	1,776	116.528
London	Mar. 31, 1907	May, 1903	1	H100 E116	6 55	*	*	*	6,736,737	...	6,133,564	603,173	141,855	567,694 810,320	15,296 14,676	582,990 824,996
N'castle-on-Tyne	Mar. 31, 1907	Dec., 1901	E.	53 *6	0 10	1,413,989	1,164,028	249,961	1,150,701	21,711	1,029,992	152,476	43,515	205,262	3,392	208,654
Northampton	Mar. 31, 1907	July, 1904	,,	9	6	128,300	127,255	1,045	127,374	14,036	115,546	11,709	2,113	21,542	542	22,084
			H.	...		...	...	...	...	...	...	...	...	770	88	858
Portsmouth	Mar. 31, 1907	Sep., 1901	E.	28	40	672,272	661,714	10,558	670,157	23,514	618,341	100,715	48,695	98,911	3,103	102.014
Preston	Mar. 31, 1907	June, 1904	,,	17	16	224,102	187,269	36,832	187,269	10,888	167,775	14,487	9,907	37,796	150	37,946
Reading	Mar. 31, 1907	July, 1903	,,	13	15	231,658	231,658	...	220,783	16,742	204,993	22,548	7,466	32,661	972	33,633
Sheffield	Mar. 25, 1907	Sep., 1899	,,	56	28	1,163,646	1,133,770	29,876	1,172,279	17,683	970,620	136,278	74,245	276,907	2,679	279,586

E—Electric trolley system. H—Horse lines. C—Cable lines. * Indicates lines leased. † Lines on which running powers are exercised.
1 Horse, conduit, and electric. 2 Surface contact.
* Conferred by Annual Money Act, which limits amount for each financial year. Powers not exercised are lapsed.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name	Operating Expenses.					Net Income.	Additions to Net Income.	Deductions from Net Income.						Net Surplus + or Deficit −
	Traffic.	General.	Repairs & Maintenance.	Power.	Total.			Interest.	Sinking Fund.	Income Tax.	Depreciation & Renewal	Sundries.	Total.	
Aberdeen	16,734	6,548	6.008	9.361	38.651	28.036	4.134	10.985	3.515	...	16.737	933	32.170	...
Ayr	3.295	1.813	1.150	2.005	8.263	6,950	70	2.400	958	303	2.367	...	6,028	+ 992
Birmingham	27,311	9.298	6.028	25,602	68.239	68,185	...	18,447	6.547	...	14,660	16,531	56.185	+ 12.000
Blackburn	11,779	3.016	7.373	11,018	33.186	21.766	...	7.583	12.878	448	...	345	21,254	+ 512
Blackpool	10.648	3.646	6,199	9,399	29.892	21.614	3,480	8.590	6.349	113	6,042	...	21,094	+ 4,000
Bolton	25.322	6.443	13.209	16,589	61,563	49.731	753	12.993	13.573	..	14,693	146	41,405	+ 9,079
Bradford	62,245	19.909	31,785	45,644	159.583	72.524	3,232	25.020	23.484	2,543	4,536	4,173	65,756	+ 10,000
Brighton	13.047	3,652	6,558	11,243	34,500	16,153	...	8,579	5,164	...	...	...	13,743	+ 2,410
Burnley	14,251	4,833	6,971	15,237	41.292	21.512	...	5,855	4,834	...	8,766	2,067	21,512	...
Burton-on-Trent	4,738	1,634	1,721	2.845	10.938	4,594	418	2.004	1.978	...	1,000	507	5.889	− 877
Bury	11,719	3.877	4,018	8,471	28.085	22,564	244	7.658	5.253	385	2.500	6,002	21,798	− 1,715
Chester	2,752	1.309	506	1.946	6.513	4.090	...	2.436	1,287	..	367	..	4,690	...
Chesterfield	2,691	635	769	1,882	5.977	5.515	...	4,060		133	...	..	4.193	+ 1,322
Colchester	3,669	1.285	1,169	3,117	9,240	2,127	...	2,485	1.732	...	...	...	4,217	− 2.090
Croydon	17,515	4.862	6,798	12,597	41,772	20.294	401	6,238	4.804	600	9,053	...	20,695	...
Darlington	3,551	671	881	2,235	7,338	3.805	35	2,437	1,941	...	..	...	4,398	− 558
Darwen	3.208	731	1.900	2.780	8,619	5.389	...	2.407	2,048	...	1.050	...	5,505	− 116
Derby	E 11,179 H 1.497	2.043 163	2,055 337	7,111 2.929	22.388 4 926	16,041 ...	548	5,657	2.387	...	...	615	8,659	+ 7.930
Doncaster	3,509	994	1.634	3,597	9.734	2.633	...	2.651	1.249	95	...	...	3,995	− 1.362
Douglas (I.O.M.)	4.019	1.756	2.546	5.322	13.643	7.891	...	1,959	885	...	2,000	2,650	7,494	+ 397
Dundee	14,020	3,748	6,138	11.498	35.404	22,268	...	8,236	5,330	300	8,316	...	22,182	+ 86
East Ham	12,901	3,039	6.185	6,847	28.972	18,116	583	5,632	5,054	248	...	2,599	13,533	− 104
Gloucester	5.472	1,402	1,527	2.654	11.055	3.978	...	5.363	2,259	...	...	836	8.458	− 4.450
Halifax	19.530	7.616	11.776	18.960	57.882	19,445	1,180	12,782	8,588	457	...	475	22,302	− 1,677
Ilford	8.206	2.430	2,207	4.286	17.129	8.261	1.666	4,804	3,949	...	792	382	9.927	...
Ipswich	7.645	1,732	2.249	4,501	16.127	5.915	..	4,157	1,753	...	...	...	5.910	+ 5
Keighley	2.523	548	465	1,656	5.192	3,048	90	1,331	1,554	...	253	...	3,138	...
Kilmarnock	2.990	747	638	1.925	6.300	2.303	...	1,886	151	19	...	652	2.708	− 405
Kirkcaldy	4.330	822	720	3,212	9.084	4.619	...	2.916	2,103	...	409	184	5,612	− 993
Lancaster	2,264	863	673	1,823	5 623	...	90	1,554	1,229	...	...	* 144	...	− 2,837
Leith	8.883	2,482	2,368	4.153	17.886	9.137	62	5.906	6,873	...	...	150	12,929	− 3,729
Lincoln	1,436	844	522	1,027	3,829	2,016	...	1,150	1,368	...	...	...	2,518	− 502
Liverpool	148,668	54,452	82,367	99,918	385.405	185,811	12,403	53,244	56,337	...	55,171	5,877	170,629	+ 27,585
Lowestoft	3,658	859	1,418	3,180	9,115	2,171	.	2,607	1,332	...	...	...	3,939	− 1,768
Maidstone	1,352	656	514	1,509	4.031	1.860	122	983	625	...	...	...	1,608	+ 374
Manchester	196,785	63,374	63,270	131,264	454.693	264,980	1,911	50,141	39,594	4,769	87,827	29,560	211,891	+ 55,000
Nelson	2,111	383	868	2.105	5,467	1,852	...	1,072	765	76	...	...	1,913	− 61
Newport (Mon.)	7,423	3,039	4,927	6,488	21.877	11,322	2,184	7,838	4,140	99	45	...	12,122	+ 1,384
Nottingham	33.457	12,553	12,563	22,483	81.056	58,937	...	15,889	16,493	...	...	2,811	35,193	+ 23,744
Oldham	20,089	4.317	8.148	21,582	54.136	39.942	1,110	12.436	13.227	277	.	6,447	32.387	+ 8,665
Perth	2,505	677	140	1,741	5,063	3,333	47	2.634	1,892	2	...	...	4.528	− 1,148
Plymouth	6,811	2,728	5,153	7,170	21,862	9,404	1,225	4,624	4,727	...	...	1,278	10,629	...
Rochdale	13.656	2.323	4,361	9,165	29,505	24,633	...	10.448	6.907	772	...	3,613	21,740	+ 2,893
Rotherham	7.566	2,215	2,171	6,899	18,851	8,885	1,463	3.737	2.260	...	4,201	150	10,348	...
Salford	61.281	14,543	21,165	45.177	142.166	90,385	4,439	20,452	18.691	1,446	14.889	26.346	81.824	+ 13,000
Southampton	14,032	4,495	7,024	11,019	36,570	14,434	...	6.222	5,192	212	2,535	273	14,434	...
Southport	4.508	1.648	1,832	3,238	11.226	7,257	6,325	6,434	4.946	...	1.977	150	13,507	+ 75
South Shields	5,038	1,852	988	4,260	12,138	11,900	111	4,504	2,859	...	2,531	2,117	12,011	...
Stalybridge, Hyde, Mossley, & D'kinf'd	14,906	3,737	4,117	9,180	31,940	6,865	...	8,949	6,115	...	...	...	15,064	− 8,199
Sunderland	18.417	5.406	4,159	12,840	40.822	31,574	704	8.751	9,014	469	6,259	661	25,154	+ 7,124
Wallasey	11,716	3,190	3,346	8,914	27,166	15,718	221	4,873	2,634	...	3,000	553	11,060	+ 4,879
Walsall	6.849	2.418	2.862	3.965	16.094	10.852	1,053	5.099	2.148	269	4,389	...	...	...
Warrington	4,996	1,460	2,178	3,813	12,447	7,093	127	3.195	2,715	...	...	...	5,910	+ 1,310
West Ham	39,667	7,858	9.084	15,810	72,419	47,356	162	14,902	7,444	650	7,722	2,810	33,528	+ 13.990
Wigan	15,416	8,038	10.560	14,807	48,821	13.648	...	18,450	10.260	...	...	1,330	30,040	− 16,392
Wolverhampton	780 10,014	116 3,313	858 3,793	409 7,417	2,154 24,537	266 19,286	... 719	... 7,808	... 4,130	... ...	... 5,783	... 359	... 18,080	... + 2,191
Yarmouth (Gt.)	6.547	1.859	1,922	3,942	14.270	7,632	...	3,376	1,962	...	...	..	5,333	+ 2,294

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast	54,732	12,296	20,277	15,953	103,258	77.881	111	34,339	21,175	...	13,000	...	68,514	+ 9.478
Bexley	3,229	1,314	1,645	2,658	8,846	4,142	127	3,132	1,810	...	...	...	4.942	− 673
Birkenhead	15,049	5,092	7,506	5,858	33,505	21,903	...	11,891	9,289	200	317	206	21,903	...
Bournemouth	22,562	6,175	10,134	14,570	53,441	30,582	1,874	12,185	12,756	...	...	6,664	31,425	+ 1,031
Cardiff	36,893	9,384	11,802	7,094	65,174	49,185	...	23,138	19,729	...	...	1,913	44,780	+ 4,405
Glasgow	245,021	86.791	122,126	31,318	485.256	410,586	3,510	63,769	49,777	9,932	168,408	51,931	343,817	+ 70,279
Huddersfield	18,959	3,931	12,086	5,065	40.041	41,155	303	12,185	9,808	806	12,427	1.206	36,432	+ 5.026
Hull	30,592	8,933	21,301	9,352	70.178	51,008	818	12,942	9,528	1,224	10,604	...	34,298	+ 17,528
Leeds	87,112	29,403	37,440	17,255	171,210	156,584	9,512	43.005	38,029	3,946	11,481	373	96,834	+ 69,262
Leicester	41,903	8,823	10,057	8,157	68,940	47,588	551	22,761	11,872	396	13,110	...	48,139	...
London	H 202,483 E 213,906	69,981 88,654	52,221 84,065	259,683 81,478	584,368 468,103	... 356,893	... 4,424	174,778	153,155	1,425	35,000	22,285	386,643	− 28,336
N'castle-on-Tyne	56,004	16,536	20,482	13,060	106,882	102,572	3,071	34,323	34,255	4,366	335	3,924	75,959	+ 28,440
Northampton	E 5,763 H ...	1,894 ...	1,339 ...	2,290 ...	11,286 1,245	10,798 ...	110 ...	... 4,353	... 3,728	... ..	... 1,355	.. 472	... 9,908	... + 1.000
Portsmouth	26,501	7,660	6,029	5,565	45.755	56,259	353	19,697	16.217	1,109	6,261	4,303	47,587	+ 9,025
Preston	10,071	4,505	4,004	2,203	20,783	17.163	...	5.822	5,773	...	5,568	...	17,163	..
Reading	8,515	3,725	2,618	3,405	18,263	15,370	...	6,558	5,607	145	3,060	...	15,370	...
Sheffield	97,590	20,245	29,662	20,922	168,419	111,167	812	41,393	25,716	2,203	20,000	2,000	91,312	+ 20,667

H—Horse lines. E—Electric trolley lines. * Deficit on Revenue Account.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Appropriation of Net Surplus. Carried Forward.	Reserve.	Relief of Rates.	Population Served.	Car Mileage.	Passengers Carried.	Passengers Carried per Car Mile.	Average Fare per Passenger. d.	Average Journeys per Head of Populat'n per Annum.	Average Car Miles per Day per Car.	Average Total Revenue per Car Mile. d.	Average Traffic Revenue per Car Mile. d.	Traffic Revenue per Mile of Single Track.	Average Traffic Revenue per Annum per Head of Populat'n Served.	Operating Expenses per Passenger. d.	Percentage of Operating Expenses to Total Revenue. %
Aberdeen ...	..	...	...	167,000	1.529.682	17,676,008	11·55	·95	105·84	35	11·112	10·332	2,522	8/4	·52	54·37
Ayr... ...	..	992	...	33,000	378.284	3,603,789	9·51	·98	109·20	104	9·637	9·294	1,520	8/11	·55	54·31
Birmingham ...	12,000															
Blackburn ...	512	...	...	200.000	1.002.372	10,094,028	10·07	1·25	50	105	13·15	12·64	2,219	5/3	·80	61·01
Blackpool ...	...	...	4,000	...	958,836	8,304,218	8·66	1·58	...	109	12·89	12·65	2,380	...	·864	58·04
Bolton	...	...	9,079	221,000	2,411,969	23,410,690	9·70	1·14	105·93	111·21	11·07	11·03	2,650	10/5	·63	53·40
Bradford	...	...	10.000	324,000	5.167,261	46,728,977	9·043	1·17	144	104·09	10·78	10·566	2,347	11/5	·819	63·76
Brighton ...	2,410	...	...	128,095	1,118.890	10,759,310	9·62	1·09	84	87·68	10·86	10·49	2,844	7/8	·77	68·11
Burnley	...	...		165,000	1.205.830	11,967,498	9·92	1·31	73	100	12·50	12·35	3,159	7/6	·83	65·86
Burton-on-Trent		...	...	52,000	421.317	3.383,527	8·03	1·072	65	58	8·85	8·60	1,529	5/10	·78	70·42
Bury	...	...	2,725	124,726	1,276.227	9,944,897	8	1·22	79·73	123·33	9·525	9·500	1,854	8·1	·677	55·45
Chester	...	...	...	38 303	291.555	2,532,778	8·687	·97	66·12	92	8·731	8·460	2,854	5/4	·62	63
Chesterfield ...	922	...	400	38,000	275.417	2,302,037	8·36	1·13	60	125	10·01	9·58	1,900	5.9	·62	53
Colchester ...	...	...	...	40.540	353.331	2.514.589	7·11	1·02	62·02	86	7·721	7·327	1.522	5/4	·88	81·5
Croydon	...		...	154,342	1,502,408	13,514,918	8·99	1·08	87·56	103	9·915	9·76	3,125	7.11	·742	66·87
Darlington ...	...	...	...	50,000	372.912	3,169,036	8·5	·82	63·38	92·9	7·171	6·964	1,217	4/4	·553	65·85
Darwen	...	...	...	41,864	240.893	2,562,234	10·63	1·2	61	71·09	13·956	13·277	1,861	6/4	·807	61·53
Derby	7,930	...	...	124,000	E. 849,248 H. 109.023	8,381,460 1.004.914	9·869 9·222	1·075 ·999	75·70	...	10·86 9·529	10·614 9·205	...	6/9	·64 1·17	58·26 113·71
Doncaster ...	...	...	...	41,500	495.404	2.753,506	5·55	1·05	66·35	122	5·991	5·828	1,143	5/9	·85	78·71
Douglas (I.O.M.)	397	...	...	...	H. 286.513 C. 121.333	2,161,667 700,227	7·017	1·696	...	70 Sum. 79 ..	12·672	11·899	3,235	...	1·144	63·36
Dundee	...	86	...	164,500	1,162,792	15,554,905	13·3	·878	93	81	11·903	11·748	2,323	6/11	·546	61·38
East Ham	...	..	5,270	125,000	1,062.151	15,049,240	14·1	·74	120	108	10·64	10·492	3,638	7/5	·50	61·53
Gloucester ...	...	...	...	50,715	519.996	3,182,111	6	1·06	62·75	94·93	6·938	6·55	948	5/7	·83	73
Halifax	...	...	...	178,000	1.624.275	18,899,242	11·62	·97	106	78	11·425	11·228	1,474	8/6	·735	74·85
Ilford	...	...	...	70,000	645.117	6,586,754	10·2	·89	94	126	9·446	9·106	2,156	7/-	·624	67·46
Ipswich	5	...	...	73,000	654.253	5.289,006	8·08	·965	75·56	70·65	8·086	7·8	1,429	5/10	·73	73·16
Keighley	...	...	...	42.000	256,715	1,935,098	7·50	·994	46·07	100·41	7·704	7·497	1,312	3/10	·644	62
Kilmarnock ...	...	...	...	36,000	328.829	2,331,277	7·09	·84	64·76	98·80	6·279	6·018	1,492	4/7	·654	73·75
Kirkcaldy ...	..	...	...	34,063	466.919	4,640,618	9·939	·692	136·2	53	7·556	7·289	1,734	7/9	·47	66·29
Lancaster ...	...	...	...	44,600	191,577	1,353,681	6·96	·950	30·35	92	6·759	6·611	1,117	2/5	·997	108
Leith	...	...	...	113,251	861,162	8,519,563	9·9	·74	75·23	112	7·531	7·352	2,208	4/8	·504	66·22
Lincoln	...	...	...	52,500	137,186	1,437,946	10·48	·95	27·39	55	10·226	10·044	1,938	2/2	·64	65·50
Liverpool ...	...	...	27,585	770,000	12,115.934	122,094,528	10·07	1·108	158·56	106	11·315	11·168	5,421	14/8	·766	67
Lowestoft ...	...	...	...	31,000	343.190	2.622.922	7·64	1·00	84·61	67	7·89	7·65	1,827	7/-	·83	87·64
Maidstone ...	374	...	...	13,000	157,050	1,186,566	8·85	1·14	91·27	92·5	9·002	8·633	710	8/8	·81	68·44
Manchester ...	...	...	55,000	800,000	15,523.459	143,264,501	9·23	1·19	179	100	11·12	11·02	4,556	17/10	·76	63·18
Nelson	...	...	...	42,000	203,203	2,035,300	10·01	·86	48·46	93	8·645	8·580	1,881	3/5	·645	74·70
Newport (Mon.) ..	1,384	...	...	75,000	772.753	7,760,404	10·04	1·007	100·81	100	10·311	10·108	2.245	8/8·15	·677	65·90
Nottingham ...	...	6,744	17,000	254,568	2,731.552	31,218,691	11·43	1·06	123	95·50	12·30	12·13	3,863	10/10	·62	58
Oldham	...	3,665	5,000	160,000	1,818,444	18,647,731	10·25	1·19	116·55	104	12·416	12·243	2,604	11/7	·697	57·54
Perth	...	...	...	34,000	229.551	1,681,188	7·32	1·14	49·45	91	8·779	8·349	939	4/8	·723	60·3
Plymouth ...	...	...	...	118,000	721,115	7,324,347	10·157	1·024	62·07	90	10·406	10·403	2,084	5/4	·72	69·92
Rochdale... ...	2,893	...	...	102,614	1,201,364	9,749,202	8·11	1·32	95	105	10·814	10·753	1,804	10 6	·73	55
Rotherham ...	...	...	...	61,500	618,211	5,743,298	9·29	1·125	93·39	109·56	10·767	10·450	2,692	8/9	·788	67·97
Salford	...	...	13,000	350,000	5.263,933	43.614,123	8·27	1·27	124·6	115·5	10·594	10·594	3,102	13 3	·782	59·99
Southampton ...	...	...	...	117,300	1,143.085	9,437,396	8·256	1·251	80	70	10·709	10·421	3,050	8/6	·93	71·70
Southport ...	75	...	...	31,312	447.821	4.068,131	9·08	1·07	129·9	102·5	9·905	9·741	1,691	11·7	·66	60
South Shields ...	...	...	...	112,000	559.948	5,654,929	10·09	1·01	50·48	99	10·30	10·28	2,337	4.3	·515	50·59
Stalybridge, &c.	...	...	...	92,811	1,422.122	9,780,464	6·877	·951	101·88	95·03	6·548	6·542	1,399	8/4	·784	82·3
Sunderland ...	..	...	7,124	170,000	1,535,425	17,483,132	11·38	1·006	102	76·8	11·314	11·261	3,687	8/6	·56	55·66
Wallasey ...	1,539	...	3,340	65,000	862,123	7,935,451	9·27	1·27	123	81·4	11·94	11·76	3,330	13/-	·816	62·60
Walsall	...		...	100,000	611.687	4,814,657	7·592	1·316	48	102	10·572	10·358	1,955	5/3	·82	59·727
Warrington ...	...	1,310	...	83,000	429,786	4,965,296	11·55	·93	59·82	103·42	10·911	10·724	1,989	4/7	·60	63·7
West Ham ...	4,322		9,668	308,284	2,556,854	35,502,836	13·88	·789	115	87	11·243	10·963	5,159	7/7	·492	60·00
Wigan	...	...	...	61,000	1,452,458	11,269,947	7·76	1·26	185	83	10·32	10·09	2,456	20/-	1·04	78
Wolverhampton	2,191	...	..	100,900	966.133	9,276,023	9·601	1·179	91·93	90	10·886	10·727	1,763	9/-	·691	57·72
Yarmouth (Gt.)..	2,294	...	...	35,000	601,535	4,296,953	7·143	1·199	122·77	73·97	8·737	8·534	1,775	12/3	·798	65·15

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast	516	...	8,962	349,180	5,296.895	42,945,849	8·11	·99	123	128	8·21	8·06	2,473	10/4	·58	57
Bexley	...	...	...	16,300	268,619	1,737,204	6·46	1·70	106·58	...	11·604	10·202	1,652	14/-	1·22	68·11
Birkenhead ...	...	...	...	117,000	1,324.743	11,696,691	8·82	1·113	100·83	83·32	10·038	9·829	2,261	9/3	·687	60·84
Bournemouth ...	1,031	...	...	100,000	1,765,098	13,503,610	7·65	1·48	135	92	11·42	11·37	2,860	16/9	·95	63·65
Cardiff	4,405	...	...	164,333	2,624.504	24,438,164	9·31	1·046	148·71	99	10·893	9·744	2,910	12/11	·653	55·83
Glasgow	...	25,279	45,000 *	1,050.000	20,350.367	224,063,098	11·01	·95	213	101·20	10·565	10·465	5,035	16/11	·52	53·96
Huddersfield ...	5,026	...	...	120,000	1,794,691	15,252,150	8·50	1·22	127	112	10·79	10·38	2,770	13/-	·63	49·32
Hull	15,000	...	2,528	266,762	2,956.406	29,151,543	9·86	1·00	109	113·68	9·84	9·84	4,456	9/1	·58	57·89
Leeds	...	...	69,262	463,495	7,454,321	73,024,853	9·92	1·065	157·55	111·38	10·69	10·56	3,352	14/-	·563	52·23
Leicester	...	...	...	232,111	3,331,998	27,467,984	8·243	1·002	118	99	8·393	8·265	3,101	9/11	·60	59
London	...	...	...	...	H13,862,718 E16,267,579	131,165,027 183,062,063	9·46 11·25	1·04 1·06	...	82 106	10·093 12·171	9·828 11·955	5,762 6,944	... ...	1·069 ·614	100·24 56·74
N'castle-on-Tyne	...	14,856	13,584	300,000	4,263.174	45,506,468	10·67	1·11	152	106	11·75	11·56	3,871	13/8	·57	50·84
Northampton ...	... ...	... ...	1,000 ...	90,000 ...	E. 541,715 H. 31,864	5,216,883 184,072	9·63 7·77	·99 1·00	60 ...	90 ...	E. 9·78 H. 6·46	9·53 5·80	2,459 ...	4/11 ...	·519 1·624	E. 51·10 H. 145·27
Portsmouth ...	4,025	...	5,000	202.000	2,199,823	20,668,825	9·40	1·15	102·32	83	11·129	10·791	3,471	9/9	·531	44·85
Preston	...	...	...	120,000	904,582	8,459,742	9·35	1·072	70·5	132·92	10·068	10·028	2,197*	6/3	·59	54·77
Reading	...	...	..	80,000	918.825	8,130,179	8·84	·96	110	112	8·78	8·53	2,476	7/10	·53	54
Sheffield	...	...	20,667	447,951	6,804,656	73,966,299	10·870	·898	165	104·6	9·861	9·767	4,174	12/4	·546	60·24

* Applied as special depreciation. H—Horse lines. E—Electric trolley system.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Average Operating Expenses per Car Mile (excludi'g Power Cost). d.	Average Operating Expenses per Car Mile (including Power Cost). d.	Average Number of Cars in Use Daily.	Number of Cars in Stock.	Average Speed per Hour. Miles.	Average Car Hours per Day.	Average Distance of 1d. Fare. Miles.	Average Fare Charged per Mile. d.	Operating Expenses per Car Mile. Traffic. d.	General. d.	Repairs and Maintenance. d.	Power. d.	Total. d.	Board of Trade Units.	Cost per Board of Trade Unit. d.	Board of Trade Units used per car mile.
Aberdeen	4·595	6·064	44	69	7	704	1·31	·81	2·625	1·027	·943	1·469	6·064	1,906,218	1·17	1·25
Ayr	3·964	5·234	10	19	8	130	1·25	·75	2·087	1·148	·729	1·270	5·234	375,436	1·28	·99
Birmingham ...																
Blackburn	5·38	8·02	26	48	7·50	364	1·25	·76	2·82	·72	1·76	2·64	7·64	1,853,272	1·43	1·84
Blackpool	5·13	7·48	24	61	6	400	...	...	2·67	·91	1·55	2·35	7·48	1,261,946	1·79	1·31
Bolton	4·47	6·12	58	96	7½	932	1·40	·70	2·518	·639	1·313	1·656	6·126	3,619,390	1·10	1·50
Bradford	5·292	7·412	136	239	7·20	2,040	1·59	·501	2·891	·925	1·476	2·120	7·412	9,582,871	1·14	1·8
Brighton	4·99	7·40	32	50	6½	512	1·31	·72	2·799	·784	1·407	2·412	7·402	1,798,905	1·50	1·61
Burnley ...	5·18	8·218	27	46	7	405	1·25	·83	2·836	·963	1·387	3·032	8·218	2,525,135	1·45	2·08
Burton-on-Trent...	4·61	6·23	9·79	20	6¾	181	1·35	·70	2·70	·93	·98	1·62	6·23	551,758	1·385	1·16
Bury	3·689	5·282	..	47	7·56	...	1·22	·83	2·204	·729	·756	1·543	5·282	2,042,840	·99	1·6
Chester ...	3·762	5·364	6·4	13	8	115	1·27	·79	2·265	1·078	·419	1·602	5·364	266,856	1·75	·91
Chesterfield ...	3·56	5·20	6	12	7·15	108	1·38	·75	2·344	·554	·670	1·641	5·209	361,421	1·25	1·31
Colchester	4·159	6·276	10·68	18	6·12	171	1·13	·97	2·492	·873	·794	2·117	6·276	498,758	1·50	1·41
Croydon	4·661	6·673	48	60	6·85	725	2·15	·52	2·798	·777	1·086	2·012	6·673	1,511,590	2·00	1·006
Darlington	3·284	4·723	11	16	6½	151	1·098	·82	2·285	·432	·567	1·439	4·723	429,105	1·25	1·15
Darwen	5·817	8·587	6	17	8·75	108	1·05	·81	3·196	·728	1·893	2·770	8·587	395,096	1·75	1·64
Derby	E. 4·318	6·327	...	39	...	...	...	...	3·16	·577	·581	2·009	6·327	1,137,705	1·50	1·34
	H. ...	10·837	...	5	..	...	...	...	3·294	·358	·741	6·444	10·837			
Doncaster	2·974	4·716	13	25	7·5	222	1·25	·8	1·7	·482	·792	1·742	4·716	575,470	1·50	1·16
Douglas (I.O.M.) ..	4·897	8·029	H 24 Sum. C 9 ,,	43 14	6	...	1·5 1·37	1·23 Sum. 1·45 ,,	2·365	1·033	1·499	3·132	8·029			
Dundee	4·934	7·307	42	60	6·2	528	1·468	·786	2·893	·774	1·267	2·373	7·307	2,207,559	1·25	1·8
East Ham	4·939	6·546	25	40	7	448	1·57	·64	2·915	·687	1·397	1·547	6·546	1,095,511	1·5	1·03
Gloucester	3·87	5·10	15	30	6·78	217	1·50	·62	2·526	·646	·705	1·225	5·102	637,491	1·00	1·21
Halifax	5·751	8·552	57	96	7·2	912	1·30	·77	2·886	1·125	1·740	2·801	8·552	3,033,499	1·50	1·87
Ilford	4·778	6·372	14	22	7·5	241	1·373	·74	3·053	·904	·821	1·594	6·372	897,916	1·146	1·392
Ipswich	4·265	5·916	19	36	6·30	216	1·53	·693	2·805	·635	·825	1·651	5·916	720,246	1·50	1·101
Keighley	3·306	4·854	7	12	7·61	126	2·35	·994	2·359	·513	·434	1·548	4·854	227,137	1·75	·88
Kilmarnock ...	3·193	4·598	9·11	14	7·43	121	1	·97	2·182	·545	·466	1·405	4·598	369,551	1·25	1·12
Kirkcaldy	3·305	4·956	18	22	6½	184	1·50	·64	2·437	·462	·406	1·651	4·956	685,269	1·125	1·467
Lancaster	4·687	6·936	6	12	8	96	1·019	·959	2·793	1·064	·830	2·249	6·936	240,820	1·817	1·238
Leith	3·828	4·985	21	37	7	315	1·56	·63	2·476	·692	·66	1·157	4·985	971,699	1·026	1·13
Lincoln	4·903	6·699	4	8	7	72	1·75	·428	2·513	1·477	·913	1·796	6·699	164,314	1·50	1·197
Liverpool	5·655	7·635	389	494	8	5,446	2·375	·43	2·945	1·079	1·631	1·980	7·635	20,381,934	1·177	1·682
Lowestoft	4·15	6·37	14	19	8	196	univ'rs'l penny fare		2·56	·60	·99	2·22	6·37	356,551	2·14	1·04
Maidstone	3·854	6·160	5	7	6·4	71·66	1	1	2·066	1·002	·786	2·306	6·16	206,932	1·75	1·31
Manchester ...	5·00	7·03	425	566	7·37	6,175	2·12	·56	3·04	·98	·98	2·03	7·03	25,072,791	1·259	1·61
Nelson	3·971	6·457	6	9	10	108	1	1	2·494	·452	1·025	2·486	6·457	252,546	2	1·24
Newport (Mon.) ...	4·779	6·794	26	40	6·67	390	1·62	·61	2·305	·944	1·530	2·015	6·794	1,153,398	1·35	1·49
Nottingham ...	5·14	7·12	77	115	6·50	15	1·62	·65	2·94	1·10	1·10	1·98	7·12	4,316,656	1·25	1·61
Oldham	4·297	7·145	48	80	6·50	864	1·12	·871	2·652	·570	1·075	2·848	7·145	3,453,037	1·50	1·89
Perth	3·473	5·294	8	12	6·25	120	1·01	1·073	2·619	·708	·146	1·821	5·294	279,694	1·49	1·21
Plymouth	4·999	7·276	28	42	7·25	336	1·75	·75	2·267	·908	1·715	2·386	7·276	938,006	1·75	1·34
Rochdale	4·065	6·028	33	59	7	495	1·14	·95	2·725	·462	·878	1·828	5·893	1,896,278	1·16	1·69
Rotherham ...	4·640	7·318	17	31	8	272	1·6	·62	2·937	·860	·843	2·678	7·318	1,103,304	1·50	1·785
Salford ...	4·418	6·476	125	177	7·75	2,125	1·50	·59	2·791	·662	·965	2·058	6·476	7,983,603	1·358	1·53
Southampton ...	5·366	7·679	45	51	7	557	1·25	·75	2·947	·944	1·475	2·313	7·679	1,333,050	1·98	1·17
Southport	4·282	6·017	14	26	6·5	210	1·3	·72	2·415	·883	·981	1·735	6·016	504,385	1·50	1·16
South Shields ...	3·37	5·20	15	35	6·89	222	1·50	·62	2·16	·79	·42	1·83	5·20	710,234	1·44	1·27
Stalybridge, etc...	3·840	5·389	41	55	6·75	577	1·24	·8	2·515	·630	·695	1·549	5·389	2,203,128	1·0	1·549
Sunderland ...	4·374	6·379	45	70	7	726	1·44	·68	2·879	·845	·650	2·005	6·379	1,826,167	1·69	1·18
Wallasey	5·082	7·562	29	35	7	435	1·50	·62	3·26	·89	·931	2·48	7·562	1,316,215	1·62	1·52
Walsall	4·760	6·314	17	28	7	255	1·24	·83	2·687	·949	1·123	1·555	6·314	662,582	1·50	1·083
Warrington ...	4·821	6·950	11·386	21	6·46	182·17	1·25	·803	2·790	·815	1·216	2·129	6·950	610,115	1·50	1·42
West Ham	5·314	6·798	80	100	6¾	1,040	1·85	·56	3·723	·738	·853	1·484	6·798	3,797,337	·99	1·48
Wigan	5·62	8·07	48	67	8	960	1	1	2·543	1·33	1·75	2·45	8·07	2,369,000	1·50	1·63
Wolverhampton ...	4·252	6·095	30	43	6½	420	1·125	·867	2·487	·823	·942	1·843	6·095	1,582,325	1·125	1·638
Yarmouth (Gt.) ...	4·12	5·693	22	31	6	324	1	1	2·612	·742	·766	1·573	5·693	539,902	1·75	·897

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

															Works Cost.	
Belfast	3·96	4·68	199	232	8·75	1,931	2·33	·40	2·48	·56	·92	·72	4·68	6,434,835	·59	1·21
Bexley	5·529	7·904	...	16	7·5	...	1·31	·80	2·885	1·174	1·470	2·375	7·904	408,497	1·561	1·52
Birkenhead ..	5·009	6·07	43·55	59	7·128	509	1·38	·64	2·727	·922	1·360	1·061	6·070	2,398,274	·58	1·81
Bournemouth ...	5·29	7·27	57	81	6·61	1,026	1·16	·87	3·07	·84	1·38	1·98	7·27	2,676,833	1·306	1·51
Cardiff	5·311	5·95	87	130	6·50	1,104	2	...	3·374	·858	1·079	·64	5·95	4,842,074	·35	1·84
Glasgow ..	5·353	5·721	543·98	780	7·91	7,616	2·29	·45	2·890	1·023	1·440	·369	5·721	24,974,056	·301	1·23
Huddersfield ...	4·65	5·32	44·25	70	6·6	708	1·25	·82	2·52	·52	1·61	·67	5·32	3,722,598	·33	2·04
Hull	4·93	5·69	71·25	116	10	1,140	2·75	·36	2·48	·73	1·72	·76	5·69	3,582,831	·63	1·21
Leeds	5·02	5·58	186	270	7·21	2,790	1·95	·54	2·84	·96	1·22	·56	5·58	13,091,475	·32	1·78
Leicester	4·377	4·965	92	140	8	1,472	2·15	·493	3·018	·635	·724	·588	4·965	5,349,665	·358	1·60
London	H 5·622	10·117	466	723	6	6,291	...	...	3·506	1·212	·904	4·495	10·117	32,782,702	·596	2·02
	E 5·704	6·906	420	671	8·5	6,300	...	...	3·156	1·308	1·240	1·202	6·906			
N'castle-on-Tyne...	5·23	6·04	111	187	7	1,665	1·58	·65	3·15	·93	1·15	·74	5·97	7,659,050	·41	1·80
Northampton ...	3·99	5·00	16·50	22	5·6	264	1·34	·68	2·55	·85	·59	1·01	5·00	878,889	·625	1·62
Portsmouth ...	4·384	4·991	73	100	6	15	1·50	·85	2·891	·835	·658	·607	4·991	2,230,460	·599	1·378
Preston	4·929	5·514	20	30	7·36	360	1	·95	2·671	1·195	1·063	·585	5·514	1,461,304	·362	1·409
Reading	3·88	4·77	25	36	7	400	1·47	·69	2·224	·973	·684	·889	4·770	1,090,416	·75	1·053
Sheffield	5·202	5·940	178·23	263	6·727	2,940	2·50	·38	3·442	·714	1·046	·738	5·940	11,546,500	·391	1·697

C—Cable line. E—Electric trolley system. H—Horse lines. * And general.

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PERSONAL.

Mr. E. Shorrocks, of Leeds, has been appointed chief clerk in the Stockport Corporation tramway office.

Mr. E. Sedgwick has been appointed car shed superintendent to the Rochdale Corporation tramways.

Mr. W. J. McCombe, manager of the Hull Corporation tramways, has been voted an increase in salary to £500 per annum.

Mr. J. Wilkinson, electrical engineer to the Hull Corporation tramways, has been voted an increase in salary to £500 per annum.

Mr. H. Richardson, city electrical engineer of Dundee, has been engaged by the Fraserburgh Town Council to report upon electricity supply.

Mr. Robert Birkett, electrical engineer of the Southend-on-Sea Town Council, has been granted an increase in salary from £450 to £500 per annum.

Mr. F. Schofield, manager of Leyton Council tramways, is to receive an annual increase of £25 in salary until a maximum of £400 has been reached.

Mr. T. Hurry Riches, locomotive, carriage, and wagon superintendent of the Taff Vale Railway, has been re elected president of the Institution of Mechanical Engineers.

Mr. N. C. Rowan has left the Sheffield power-station, and has taken up an appointment with the Cleveland and Durham Electric Power Company, Limited, of Middlesbrough.

Mr. John Varley, of 11, Stanley Gardens, London, W., has been appointed a director of Callender's Cable and Construction Company, Limited, in the place of the late Sir D. Evans.

Mr. Walter Gott, passenger agent of the Bakerloo, Piccadilly, and Hampstead tube railways, lectured on February 21 before the Bradford Scientific Association on "How the Travelling public are Protected."

Alderman Sir Robert Anderson, Lord Mayor of Belfast, has been elected chairman of the Tramways and Electricity Committee for the ensuing year. Mr. R. J. McMordie has been chosen for the position of vice-chairman.

Mr. A. S. Campbell, who has been temporarily engaged as resident engineer on the electrification of the London County Council tramways for five years, is to be placed on the permanent staff as principal assistant in the engineer's department at a salary of £425 per annum.

Mr. John Aldworth, general manager of Nottingham Corporation tramways, in accordance with the recommendation of the Tramways Committee, will receive an increase in salary to £1,000 per annum. Mr. Aldworth is president of the Municipal Tramways Association for this year.

Mr. G. J. Lawson, J.P., for seven years chairman of the Bournemouth tramways committee, on leaving the Council, has been presented by the tramways staff and employees with an illuminated address and a diamond ring, "in recognition of his kindness, support, and attention to their welfare."

Cammell Laird Directorate.—At a meeting of the directors of Cammell Laird and Company, Limited, held on February 12, Mr. Arthur Daulby Wedgwood, late of the Dennystown Forge Company, was appointed managing director. Mr. Henry Edward Deadman, C.B., late of the Admiralty, and Major Arthur Handley, late R.A., were elected directors.

Mr. A. L. C. Fell, chief officer of London County Council tramways, has been granted an increase of salary from £1,500 to £1,750 per annum. The Council have also approved of increases of salaries to a number of officials in the tramways department, particulars of which will be found in our report of matters dealt with at the meetings of the Council.

Mr. H. S. May, tramway engineer and rolling stock superintendent to Blackpool Corporation, has been appointed assistant rolling stock superintendent for the London County Council's tramways, at a salary of £250 per annum. Mr. May, resident engineer of the Blackpool Corporation tramways, has been presented by the staff with a gold watch on his leaving Blackpool.

Mr. Aldredo Maia, a prominent Brazilian engineer and former Minister of Public Works and Railways, has been elected a member of the board of the Rio de Janeiro Tramway Light and Power Company, Limited. For many years Dr. Maia had charge of the Central Railway of Brazil, the Government railway system, and subsequently was managing-director of the Sorocabana Railway during the period of its ownership by the State of Sao Paulo.

Mr. David James, general manager of the Swansea Improvements and Tramways Company, was on February 4 presented by the employees of the company with a gold watch in token of the esteem in which he is held. Mr. James is in his twenty-eighth year of service with the company. He occupied the chair at the annual dinner of the employees when the presentation was made by Mr. A. Thomas on behalf of the employees. Mr. James, in expressing his thanks, said he would value the gift as a momento of the hearty relations which had ever existed between him and the magnificent body of men who had loyally supported him in all his efforts. That the men were contented was proved by the fact that many of them had served 15 or 20 years under the company. He also proposed the health of the chairman of the company, Mr. C. G. Tegetmeier, and paid a high tribute to that gentleman and to the directors generally. The fact that there never had been any friction was largely due to the manner in which the directors treated every suggestion made for the advantage of the men, which they met as far as they possibly could. There were in existence a friendly society, to which the directors largely contributed, a bonus scheme which had proved very helpful, and a provident fund, which through the generosity of the board, realised 3½ per cent. The Mayor of Swansea (Alderman Lee) spoke of the high efficiency of the tramway system, and to his desire to promote an amicable feeling between the Corporation and the company.

NEW CONTRACTS AND ORDERS.

Messrs. Edgar Allen and Company have received an order from Sheffield Tramways Committee for points and crossings.

The General Electric Company has received an order from Rochdale Corporation for a steam dynamo, with Browett engine.

W. T. Henley's Telegraph Works' tender for feeder cable has been accepted by Ilford Council at £1,130.

Hadfield's Steel Foundry Company have received an order from Portsmouth Tramways Committee for points, crossings, and junctions, at £4,496 5s.

Messrs. Walker Brothers, of the Pagefield Ironworks, Wigan, have supplied a petrol motor tower wagon to the Wigan Corporation tramways.

East Ham Town Council has accepted the quotation of Messrs. Milnes, Voss, and Company, for providing top-deck covers for ten cars, at £90 per car.

J. R. Williams and Company, Liverpool, have been awarded a contract by Aberdeen Tramways Committee for 17,000,000 tramway tickets at 1¾d. per 1,000.

Sheffield Corporation have placed an order with Messrs. George Robson and Company, of Sheffield, for one of their "Eclipse" patent portable electric track grinders.

Dick, Kerr and Company have been awarded a contract by the Hertfordshire County Council for the construction of the Cheshunt light railway, at £4,175.

Portsmouth Tramways Committee have placed a contract with Messrs. William Cory and Son for the supply of coal for six months, at 12s. 2d. per ton.

Thermit, Limited, has received an order for the welding of joints on the Cheshunt Light Railway, which is being constructed for the Hertfordshire County Council.

The Chloride Electrical Storage Company are to supply a positive battery to the Southend Town Council, at £420, with £37 15s. per annum for ten years' maintenance.

Callender's Cable and Construction Company have a new contract with Croydon Town Council for the supply of cables for the ensuing two years, on the basis of copper not exceeding £66 per ton.

Burnley Tramways Committee has recommended the purchase of five additional bogie cars, similar in design to those recently put into service on the Manchester Road route. The cost is estimated at £800 each.

The Continuous Rail Joint Company have received an order from the Glasgow Corporation for 50 tons of continuous rail joints. The Plymouth Corporation have also ordered continuous rail joints.

Messrs. H. Lotery and Company have received large orders for uniforms from the Nottingham Corporation and the Lancashire United Tramways, from the Chatham and District Light Railway, and from the Metropolitan Asylums Board.

Messrs. A. Blyde and Company, of the Wallace Steel Works, Sheffield, inform us that the London United Tramways, Limited, have accepted their tender for the supply of all their tool steel for the year 1908.

Cardiff Corporation has accepted the tender of the British Westinghouse Electric and Manufacturing Company for a 500 KW. motor-generator at £1,345. There were 21 tenders, ranging in price from £1,135 to £1,966.

The Lahmeyer Electrical Company, Limited, of 109-111, New Oxford Street, London, W.C., have received an order from Lowestoft Corporation for the supply of service cables during the ensuing year, the average price being £248 per mile.

Messrs. Watlington and Company, of Moorgate Station Chambers, London, E.C., are the European agents for the United States Electric Signal Company, whose signals we described in an

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article on "Signals for Trolley Car Lines," which appeared in our issue of January 2.

Edinburgh and District Tramways Company have placed a large order for steel haulage cables with Thomas and William Smith, Newcastle-on-Tyne. The total length of cables included in this and other recent contracts with the same tramway company is 248 miles.

"Winby" Soleplates have been recently ordered by the following tramways; Plymouth, Stonehouse and Devonport Tramways, Carlisle Tramways, Glasgow Corporation and Lanarkshire Tramways. The Plymouth Corporation have ordered "Winby" anchor chairs.

Ashton-Under-Lyne Corporation.—The Tramways Committee have placed an order with Messrs. Dick, Kerr and Company for 13 double-deck, top-covered cars, which are to be equipped with Wust's patent double helical wheels and pinions, manufactured by the Power Plant Company, West Drayton.

Dundee Tramways Uniforms.—Dundee Tramways Committee have fixed contracts as under: Smith Brothers, tunics and trousers, at 41s. 9d. per suit; J. Millar, caps, at 2s. 5d. each, and covers at 7d. each; Kidd and Wallace, oilskin coats at 17s. 6d. each, waterproof capes at 9s. 11d. each, and sou'-westers at 1s. 2d. each.

Willans and Robinson, Limited, have been awarded a contract by Glasgow Electricity Committee for the supply of two 4,000 KW. turbo-generators and condensers at the price of £32,043. The additional plant is required before next winter at the Port Dundas and St. Andrews Cross stations. The generators will be made by Dick, Kerr, and Company, Limited, and will be of their standard type.

Birmingham Corporation tramways department will obtain from Messrs. Dick, Kerr and Company 30 additional cars. Three of these cars will, in accordance with the permission of the Board of Trade, be fitted with Maley's electro-mechanical track brake, which has been used on several cars of the Leeds Corporation tramways, and was described in THE TRAMWAY AND RAILWAY WORLD of December 5, 1907.

West Ham Electric Lighting and Tramways Committee has accepted the offer of the Bell Punch and Printing Company to extend the contract for ticket punches for a period of three years, the rate to be 12s. per punch per annum. The committee have also placed a contract with Messrs Wm. Cory and Sons, Limited, for 12,000 tons of North Country coal at 10s., and 12,000 tons at 9s. 8d., a slightly lower calorific value accounting for the difference in price.

Gloucester Town Council have accepted the following tenders for tramway supplies: Micanite plate, red fibre sheet, asbestos sheet, and Baker's fluid, L. Andrews and Company; light car oil, Anglo-Russian Oil Company; anti-friction metal, Anti-Friction Metal Company; cables, British Insulated and Helsby Cables, Limited; car wheel tyres, Brown Bayley's Steel Works, Limited; brake blocks, J. M. Butt and Company; para strip, Henley's Telegraph Works Company; press pahn, P. and B. insulating tape and electrical compound, Ruberoid Company.

The Railway and General Engineering Company, Limited, have received an order from Mr. Fearnside Irvine, consulting engineer to the Lisbon Electric Tramways, Limited, to construct a specially designed tramway rail grinding machine. The same company have also an order for the West Hartlepool Electric Tramways Company, Limited, to repair 318 joints and fit in their patent renewable plates, in addition to which the Railway and General Engineering Company are repairing 150 joints on the Bristol tramways. The St. Helens Corporation have ordered a number of renewable plates, which will be fitted under the direction of the borough engineer, and also an electrically-driven shaping machine.

London County Council have accepted tenders as under: Dick, Kerr and Company, reconstruction on the conduit system of tramways in Caledonian Road and Seven Sisters Road, £53,517; Dick, Kerr and Company, laying of cable ducts for the same tramways, £3,576; Johnston and Phillips, manufacture and laying of low-tension cables and telephone cables for the same tramways, £4,021; The Electric Construction Company, a motor generator of 50 KW. at £541 10s.; P. and W. M'Clellan, 115 tons of flat-bottomed rails for the car repairing depot at Woolwich Road, at £7 6s. 3d. per ton; and the India-Rubber, Gutta-Percha, and Telegraph Works Company, 300 plough bases at 54s. each, and 600 leads at 4s. each.

Belfast Tramways and Electricity Committee recommend the acceptance by the Harbour Commissioners of the tender of Dick, Kerr and Company, Limited, for the construction of tramways on the County Down side of the harbour. The contract, which has been confirmed by the Corporation, amounts to about £17,000.—The committee on February 24 adopted a report by Mr. Nance, the general manager, recommending the purchase of three sets of Tierney's automatic point controllers at £80 a set, this type being in the manager's opinion the best yet invented. If these sets prove satisfactory in practice others will be obtained. The capital expenditure of fitting controllers to all the movable points in Belfast will be about £3,500, and the annual expenditure including fixed charges will be about £300. The present arrangement, with point boys, costs about £1,750 a year.

TRAMWAY AND LIGHT RAILWAY NOTES.

ABERDEEN.—The Tramways Committee have agreed to recommend that six additional cars be fitted with top covers at £155 each.

BELFAST.—The poll of the ratepayers of Belfast on the question whether the Corporation should proceed with their Parliamentary bill for the purchase of Cavehill and Whitewell tramways has resulted in the proposal being approved by 24,733 votes against 12,575. The agitation against the purchase has been carried on largely by the Belfast Trades Council.—At a meeting of Belfast Tramways Committee on February 10, a letter was read from the men's trade union asking for an advance in the present rate of wages for motormen and conductors, fixing the maximum at 7d. per hour, to be reached after three years' service. After receiving a report from the manager, the Committee decided to adhere to an arrangement already decided upon, which provides that the men shall receive the maximum pay of 6½d. an hour after three years' service. This will mean an additional cost of £1,300 a year.—At a meeting of Belfast Tramways and Electricity Committee on February 24, Mr. Nance, the general manager, submitted a report on a suggested revision of fares. He stated that he was strongly of opinion that a penny maximum fare should be aimed at and adopted as soon as it is possible to do so without jeopardising the financial position of the undertaking. Halfpenny fares, in his opinion, would mean financial disaster. He urged that the Committee should fix the fare at one penny from Castle Junction to any terminal point, the cross-town stages to remain as they are at present. He thought the change proposed would not diminish but would increase the revenue. The consideration of the report was adjourned for a fortnight.

BIRMINGHAM.—The Tramways Committee have reported that in consequence of increased services required on the tramway routes it has been necessary to order thirty more cars, bringing the total number to 300. In a report by the Tramways Committee, it is stated that Mr. Baker, the manager, has called their attention to the Maley track brake for tramway cars, which has undergone some very severe tests on one of the routes of the Leeds tramways. The Board of Trade has expressed its willingness to allow the use of this brake on three cars for a period of three months, and the Committee instructed the manager to have these brakes fitted on three of the thirty new cars now on order. The Maley brake was described in our issue of December 5, 1907.—There was at least a fine impartiality shown by the summoning before the Victoria Courts, Birmingham, of a tramcar conductor in the service of the Corporation, and another in the employment of the tramway company, for permitting overcrowding of the cars under their care. The alleged offences took place on the day of a great football match. In one case there were 12 excess passengers, and in the other there were 16. The cases had been adjourned, and, on being resumed on February 18, Mr. Combridge, one of the magistrates, said that what they wanted to know was whether the overloading was winked at by the officials. It was unfair that the men should be made the scapegoats for the higher officials, and when they gained nothing by the overcrowding, should have to bear the fine. Mr. Cooling, traffic superintendent, for the company, and Mr. McDonald, for the Corporation, said it was impossible to tell from the way-bills whether or not a car was overloaded, since passengers were continually getting on and off. Mr. Combridge pointed out that the police did all they could to assist in loading the cars, and they were in the peculiar position of having, as Corporation servants, to summon other Corporation servants for breaking the Corporation by-laws. One of the conductors, who had been summoned on a former occasion, was fined 2s. 6d., and the other was dismissed with a caution.

BOURNEMOUTH.—The Town Council have resolved to appeal to the House of Lords in the case between them and the Poole Traction Company. It was stated by Mr. Banks to the meeting that the judgment given in the Court of Appeal in favour of the company amounted to £6,476, plus £2,570, making a total of £9,046. The Corporation, by resisting the original claim, were better off by £4,433 than if they had claimed without litigation. No costs were awarded the company in the Court below. It appeared in the course of discussion that the costs to the Council up to the present were between £200 and £300, and that the costs of an appeal to the House of Lords would be about £500.

BRADFORD.—The Tramways Committee have decided to spend £21,000 on track renewals and on doubling a line in Listerhills district.—A sub-committee of the Town Council have been appointed to consider and report on the question of making provision, by superannuation, thrift fund, or other means, for workmen who may be thrown out of their employment in the tramway department by age or physical infirmity.—The Tramways Committee have taken commodious premises in Hall Ings for use as central offices.

BRAY.—A scheme for electric tramways from Bray to Enniskerry and for lighting the latter town is before the local authorities concerned, and is meeting with considerable approval. The promoters will seek powers by memorial to the Lord Lieutenant of Ireland for an Order in Council.

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CARDIFF.—The new transfer ticket system in Cardiff promises to be very successful. For the first fortnight of its operation the total number of tickets of all kinds issued showed an increase of 60,000 as compared with the corresponding fortnight of the previous year, and the receipts showed an increase of £230. Mr. Arthur Ellis, the manager, has stated that the success of the scheme has far exceeded anything that he or anyone else could possibly have anticipated. It may be recalled that an article was published in our issue of April 4, 1907, on "A Simple Method of Increasing Tramway Revenue," by Mr. John Jack, Edinburgh, which explained and advocated the use of a penny transfer fare for short-distance travel, and it is this scheme to which a trial is being given in Cardiff. The traffic is controlled by the ticket which Mr. Jack has invented for the purpose of this and similar fares.

CROYDON.—At a meeting of Croydon Town Council, a report was submitted from a joint sub-committee with regard to the meters in the generating station used for measuring the current supplied to the tramways. Meters which had been registering erroneously had been replaced by new ones, which had been tested at the Board of Trade laboratory. The new meters showed a consumption of 1·29 units per car mile, as compared with 1·006 units a year ago. Alderman Trumble said that the increase would be a serious matter for the Tramways Committee and, under the circumstances, they proposed to ask the Electricity Committee to take into consideration the whole matter of the price. The increase meant at least £4,000 for the tramways Committee to pay over to the Electricity Committee. The report was adopted.

DERBY.—The new Nottingham Road route of Derby Corporation tramways was inspected on February 8 by Major Pringle, of the Board of Trade, and later on the same day the public service commenced. This completes the present scheme of extensions in Derby.

DUBLIN.—In the Nisi Prius Court, on February 17, a jury awarded James Hand, a van driver, £475 damages against the Dublin United Tramways Company in respect of injuries received through a tramcar dashing into the vehicle which he was driving. It was stated that the plaintiff was so injured as to be unfit to continue to follow his occupation.—The King's Bench Division of the Irish Law Courts on February 24, gave judgment in favour of the Dublin United Tramways Company in an application made by them to have the finding of a jury set aside in the case brought against them by Michael Mullen, a carter. Mullen had been awarded £150 in respect of personal injuries caused by a collision between a tramcar and his cart. The Lord Chief Justice and Mr. Justice Madden held that there was evidence of negligence on the part of the plaintiff, and none on that of the defendants. Mr. Justice Dodd and Mr. Justice Wright took a different view. In accordance with the rule when the Court was divided in opinion, Mr. Justice Dodd, as the junior judge, withdrew his judgment, and judgment was entered for the company with costs.

DUNDEE.—A further report by Mr. Fisher, the general manager, on the question of fares, has been presented to Dundee Tramways Committee. In this Mr. Fisher pointed out the anomalies in the present halfpenny stages, some of them being much longer than others. If any changes were made, he suggested various details as advisable. In general, he was strongly of opinion that a penny maximum fare should be aimed at and adopted as soon as it was possible to do so without jeopardising the financial position of the undertaking. The sum collected from fares over one penny for the year ended May 15 last was £2,159. The department was not yet in a position to drop this sum, but if the newer lines were developed so as to earn the average rate on a fairly satisfactory mileage it might then be possible to adopt the penny maximum. With a penny maximum fare and halfpenny stages for short distances, as at present, such facilities would be offered to the public as would tend to induce a larger population to live towards the outskirts of the city instead of removing to the adjacent burghs. With this end in view, he would strongly recommend that developments should proceed on present lines, and especially that no substantial alteration should be made on the halfpenny stages.

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DUNFERMLINE.—It is announced that the construction of the authorised tramways from Dunfermline to Cowdenbeath and other towns in the district will be commenced in the coming summer, and that Mr. George Balfour, who is associated with other Scotch tramway companies, has acquired a controlling interest in the scheme. The total length of lines is about 15 miles, of which 11 miles will be put in hand at present. Current will be purchased from the Fife Electric Power Company.

EDINBURGH.—Mr. Wm. Campbell, K.C., Dean of Faculty of Advocates, has issued his finding as arbiter on the question of the running of the cable cars on the Grange circular route in Edinburgh. Some time ago the tramways company stopped the running of cars on the circular route, and their action was questioned by the Town Council. The dispute was submitted to the Dean of Faculty, and after hearing parties he has found that the tramways company are bound to resume the car service on the circular route.

GLASGOW.—Efforts are still being made by various sections of the community in and around Glasgow to obtain extensions of the Corporation tramway system. In reference to two recent proposals of the sort the Tramways Committee have adhered to the decision to delay consideration until a report on the general policy regarding future extensions has been submitted to the Corporation. The Town Council have already done more than most local authorities in the way of extending tramways beyond the city boundaries, and this policy is resulting in a spreading out of the population so that the demand for further extensions still goes on. The question of a limit has to be faced, and sooner or later it is probable that more encouragement will have to be given to companies to provide additional interurban tramway facilities.—In order to obviate the nuisance of used tickets being thrown down in the cars and on the streets, Mr. James Dalrymple, the general manager, is having boxes fitted at the ends of each car, into which passengers will be asked to drop their tickets when they come to the ends of their journeys. He hopes that in course of time the public will fall into the habit of putting their tickets into the boxes.

GRIMSBY.—At the annual dinner of the employees of the Great Grimsby Street Tramway Company, given by the directors, Mr. H. L. White, the manager, announced that the board had acceded to his request to give all men of three years' service six days' holiday with pay, and all men of over twelve months' service three days' holiday with pay. Complimentary speeches were delivered by Mr. Andrew Beattie, chairman of the company; Mr. J. Barber Glenn, managing director and secretary; Mr. White, and others.

HALIFAX.—At the request of the Halifax Corporation Tramways Committee, Major P. Cardew and Mr. H. Graham Harris on February 6 inquired into the structural form of the cars and the types of brakes in use on the Halifax tramways. Besides taking evidence, they visited the car depot, and made a tour of the routes.

HULL.—The Tramways Committee have decided to make a contribution of £20,000 towards the reduction of rates during the ensuing year.

KEIGHLEY.—The Tramways Committee of Keighley Corporation have reported that they do not propose to ask any assistance from the rates for the tramway undertaking for the year ending March 31 next. This is the first time since the tramways were started that no rate aid has been required. A grant of £400 last year has, however, not been required, and for the current year it is expected that there will be a surplus of from £500 to £600.

KIRKCALDY.—At the annual social gathering of the employees of the tramway and electric lighting departments of Kirkcaldy Town Council on February 5, Mr. George Fergusson, convener of the Tramways Committee, stated that since mutual through running of cars had been begun with the Wemyss and District Tramways Company on November 14 last till January 22, the corporation cars had carried 30,000 more people than they had done for the corresponding period in the previous financial year, and they had taken £145 more in fares. They had also saved in car miles £180, which gave a total increase of £325. He considered the system would at the end of the year have made a profit of £1,200. Last year they had carried 4,640,000 passengers, and by May 15 next he expected they would have carried 5,000,000. That was a record of which they ought to be proud. The Wemyss tramways had been a great help not only to the Corporation tramways, but also to the shopkeepers.

LEEDS.—Sub-committees of Leeds and Bradford Tramways Committees held a joint meeting at Leeds Town Hall on February 10, in regard to the proposed service of through cars between the two towns. It may be recalled that the difficulty arising from the fact that the two tramway systems have different gauges was overcome by the new type of car truck designed by Mr. C. J. Spencer, the tramway manager, and Mr. W. H. Dawson, the deputy city surveyor of Bradford, which has been described and illustrated in our pages. The trials of a car fitted with this truck extended over five weeks, during which time the car ran satisfactorily over both gauges. The

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meeting was held for the purposes of arranging terms for a permanent through service, and proposals were made for submission to the Bradford Tramways Committee.

LONDON.—At Brompton County Court a jury awarded Cornelius Marshall £350 damages against the London United Tramways Company. As the result of a collision between a tramcar and a pantechnicon van which the plaintiff was driving, he was thrown to the ground and seriously injured.—Before the end of April passengers will be able to travel *via* Westminster Bridge by the London County Council cars from Highbury to almost any part of South London. The extension of the Kingsway-Aldwych tramway subway to the Victoria Embankment is practically completed. Only single decked cars will, however, be able to pass through the subway.—In connection with the electrification of the tramways from Whitechapel Road to Stamford Hill the Hackney Borough Council have decided to contribute £17,000 towards the necessary widenings in Mare Street and Clapton High Road. The total cost of the improvements is estimated at £51,000. To avoid the widening of Mare Street at its narrowest point a loop line is to be constructed along the lower portions of Amhurst Road and Dalston Lane.—At a meeting of the London County Council on February 18, Alderman Thompson, Chairman of the Highways Committee, stated that although the Hackney Borough Council had agreed to pay one-third of the cost of street widenings for tramways, it would be some time before the electrification of the lines could be put in hand. Certain existing stumbling blocks had still to be removed. —Brentford Urban District Council is of the opinion that much of the noise complained of by residents on the tramway route is due to the defective condition of the track. It proposes, therefore, to require the company to re-pave the track on the main road and renew the rails. Failing compliance with the request, proceedings are to be taken under the Tramways Act of 1870.

MORLEY.—At a meeting of Morley Town Council on February 3, it was agreed by 15 votes against 13 to purchase the authorised light railways to be constructed in the borough. It was explained by the Mayor (Alderman S. Rhodes) that, under the existing arrangements, if the Corporation exercised their power of purchase, the company who had the authority to construct were bound to take the undertaking on a lease for 28 years, and to hand over the lines in good working condition at the end of that period. During the lease the Corporation would receive £3,114 per annum, which, he said, would go in reduction of the rates.

OLDBURY.—A tramcar was on February 20 proceeding from Dudley towards Oldbury, and on reaching Tividale it left the rails and overturned. The conductor, who was on the top collecting fares, fell off below the car as it capsized and was killed. Several passengers were injured. At the adjourned inquest on February 27, the Coroner said that there did not appear to have been any reckless driving, nor any defect in the line. The only thing the jury could recommend the company to do, if they thought it advisable, was that they should use a wheel of a different design. He could not see that there had been neglect by any individual. The jury returned a verdict of "Accidental death," and added a rider to the effect that the company should consider the advisability of using a better class of wheel.

OXFORD.—The King's Bench Division on February 12 gave judgment in a special case stated by the arbitrators employed to fix the price to be paid by the Corporation of Oxford in purchasing the tramways from the local company. The question was whether the value was to be that of a going concern or the value under the compulsary purchase clause (section 43) of the Tramways Act, 1870 The Lord Chief Justice said that the Corporation could not give their notice to buy under section 43 till September 25 last. Both they and the company, however, had been willing to make a contract which would anticipate that period by nine months. The agreement stated that the Corporation would purchase the undertaking under section 44, but should only pay the then value as provided by section 43. He was of opinion that the price payable was that under section 43, and decided in favour of the Corporation. The other judges concurred.

SOUTHPORT.—As the result of a conference between Southport Tramways Committee and representatives of the employees, the Committee have agreed to the following rates of pay: Motormen: Probationary six months, 5½d. per hour, then 6d. per hour for three years, after the expiration of which the men will receive a rise of ½d. per hour. Conductors: Probationary six months, 4½d. per hour, subsequent three years, 5d per hour, and, after the expiration of three years, 5½d. per hour. The Committee have further agreed to abolish the stripes system, and have decided to recommend the six days' holiday each year. The result of the conference has given great satisfaction to the men.

STALYBRIDGE.—The Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways and Electricity Board are asking for sanction to borrow £20,223 for additional plant at the generating station, and £5,000 for the purchase of transformers

TORQUAY.—Work on the extension of the tramways to Torbay Road and Torquay Station was commenced during February, and is being rapidly carried on. The tramway officials expect that the lines will be completed as far as the Grand Hotel by the month of May.

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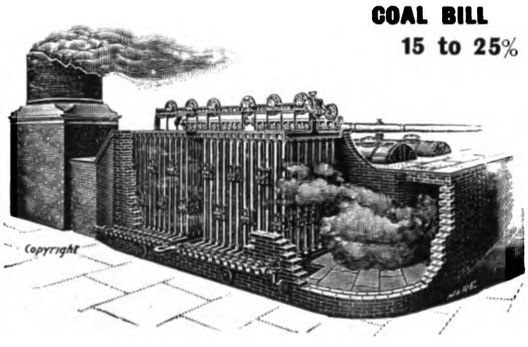
Saves Wear & Tear of Plant.

REDUCES the COAL BILL 15 to 25%



Patentees and Sole Makers—

E. GREEN & SON, LD., Wakefield, Manchester, London, and Glasgow.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

∴ If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS.

Applications for Letters Patent have been filed:

1,956 Jointing of tramway rails—K. Edwards.
1,980 Life-guard for tramcars—W. Binnion.
1,981 Tramcar brakes—A. W. Maley and E. H. Cockshott.
2,061 Railway or tramway points and signals—J. O. Brettell, and McKenzie and Holland, Limited.
2,082 Current collectors for electric traction systems—The British Thomson-Houston Company, Limited (*General Electric Company*).
2,214 Trolley heads—J. Juille.
2,318 Emergency or slipper brakes for tramway and railway vehicles —P. McCullough and J. A. Panton.
2,354 Railway rail joints—B. B. Bonner and T. W. Bonner.
2,357 Track or emergency brakes for tramcars—J. Lambert.
2,379 Axle-trucks or under-carriages for tramcars—W. Rhodes.
2,456 Brakes for tramcars—A. Steward and H. Rebbla.
2,488 Insulated joints for railway rails—B. Wolhaupter.
2,495 Electrically-propelled motor road vehicles—A. G. Bloxam.
2,651 Apron for reversible back tram seats—H. B. Harris.
2,857 Railroad rail joints—S. A. Neuhard.
2,890 Non-skid arrangement for motor 'buses—J. F. Smith.
3,066 Joints for railway rails—B. Wolhaupter.
3,184 Fastening and protective device for the doors of tramcars—M. H. Whittaker.
3,321 Trolley poles—W. G. Whitfield.
3,418 Brakes for tramway vehicles—R. H. Wilkinson.
3,505 Current-collector for electrically-propelled vehicles—G. Mertens.
3,590 Safety or catching net for tramcars—G. Emons.
3,604 Trolley heads—F. J. S. Hosken.
3,723 Electro-magnetic brakes and clutches—D. K. Morris and G. A. Lister.

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3,823 Safety-guard for tramcars—W. Logan.
3,850 Conduit tramway continuous-current supplier—E. G. Manning.
3,868 Rail cleaners for tramways—A. H. Shaw.
3,894 Electric railway signalling system Y. Burgess.
3,950 Operating brakes of self-propelled vehicles or tramcars A. Johnston.
4,021 Track brake-operating mechanism for tramcars—Mountain and Gibson, Limited, and F. Tolkien.
4,031 Brakes for mechanically-propelled vehicles—F. J. A. Paton.

Specifications Published.

1906.

28,724 Mechanical ears for carrying overhead transmission cables for electrical traction purposes—Oliver.

1907.

298 Magnetic clutches and brakes—Ravenshaw, Middleton and Townsend.
759 Brakes for tramway cars—Howard.
3,885 Brakes—Leplow.
7,408 Electric locomotives—British Thomson-Houston Company (*General Electric Company*).
9,414 Lifeguards or obstruction removers for tramcars—Wildbur.
15,983 Controlling device for fare indicators—Jensen (*Dunholter and Schölzel*).
18,479 Machine for tooling rails at their place of junction—Jensen (*Vereinigte Schmirgel-und-Maschinenfebriken Ges. vorm S. Oppenheim and Company, und Schlesinger and Company*).
20,655 Railway rails—Thomas.
23,497 Spring support for an electric motor arranged on the axle of a vehicle—Siemens-Schuckerwerk Ges.
1,449 Braking of electrically-propelled vehicles—Fraser.
2,312 Facing point switches for railways and tramways—Taylor (*Harding*).
4,274 Interlocking apparatus for railways and tramways—Edmonds and McKenzie and Holland, Limited.
10,623 Windows of railway and like passenger cars—Ostrander.
15,304 Wheels of vehicles adapted to run on rails—Lance.
17,722 Electric controllers—British Thomson-Houston Company (*General Electric Company*).
20,079 Railway rail joints—Thomas.
22,322 Brakes for tramway and railway vehicles—Jones.
27,956 Axle bearings—Aldridge.
6,057 Overhead conductors for electric tramways—Bill.
17,947 Automatic gong-ringing device for electrical street railway cars—Fallek.
19,318 Washing apparatus for railway carriages and tramcars—Marshall.
24,172 Cable car grip—Lawsha.
25,614 Railroad ties—Covington.
2,413 Electrical block-signalling system for railways—Brown.
5,270 Combined interlocking portable railway or tramway and gantries—Lennox and Lennox.
9,963 Electrically-operated signals for railways—British Thomson-Houston Company (*General Electric Company*).
11,229 Adjustable windows for covered car bodies—Hewer and Hewer's Car Bodies, Limited.
14,878 Apparatus for retaining seats in railway and tramway vehicles—Duret.
21,029 Tramway and railway tracks or rails—Briggs.

POSITION WANTED.

ENGINEER OR MANAGER.

Engineer recently returned from the Argentine desires position. Thoroughly experienced in electric tramway construction and management. Excellent record.

Address G B., care of The Tramway and Railway World, Amberley House, Norfolk Street, Strand, W.C.

WANTED.

OLD STEEL TRAMWAY RAILS.

Wanted to purchase 500 tons of Old Steel Tramway Rails, 6 × 6, or 7 × 7. Apply Marple and Gillott, Limited, Engineers, Sheffield.

Mr. JOHN E. RAWORTH,

Chartered Patent Agent,

QUEEN ANNE'S CHAMBERS, BROADWAY, WESTMINSTER.

CONDENSING PLANT.

The Mirrlees Watson Company, Limited, of Glasgow, make a special feature of the manufacture of Independent Condensing Plants having either Wet or Dry Air Pumps, and suitable for working in connection with Reciprocating Engines or giving the high vacuum desirable with Steam Turbines.

axles never parallel

MAIN LINE EXPRESS — **TRUCKS** — ELECTRIC RAILWAY
MINING TRUCKS — **WARNER** — SPECIFICATION DESIGNS
ELECTRIC TRAMCAR — **SUPREME** — LICENSEES ALL COUNTRIES

WARNER ENGINEERING COMPANY DARTMOUTH ST SW ENG

TRAFFIC RETURNS.

TRAMWAYS AND OMNIBUSES.	1907. WEEKS ENDING. Jan. 26.	Feb. 2.	Feb. 9.	Feb. 16.	Feb. 23.	1908. WEEKS ENDING. Jan. 25.	Feb. 1.	Feb. 8.	Feb. 15.	Feb. 22.	AGGREGATE. Wks.	1908.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	1.118	1.102	1.149	1.144	1.187	1.121	1.113	1.149	1.202	1.147	38	52.670	- 1,291
Ayr Corporation	153	160	157	168	167	172	173	175	181	183	41	12.175	- 5
Bath Electric	653	588	557	558	584	566	562	553	577	558	7	3.907	- 317
Belfast City	3.016	3.036	3.123	3.109	3.203	3.344	3.307	3.439	3.442	3.598	47	171,076	+ 11,525
Birmingham Corporation	4.977	5.005	5.123	5.360	5.290	6.118	6.295	6.298	6.258	6.277	8	47,257	+ 6,967
Blackburn Corporation	870	782	897	844	869	957	918	940	934	935	47½	51,750	+ 3,508
Blackpool and Fleetwood	167	201	196	181	172	183	176	200	208	201	8	1,475	+ 40
Blackpool Corporation	306	295	305	318	344	307	281	353	333	351	46	50.248	- 1.178
Bolton Corporation	1.845	1.957	1.912	1.904	1.912	1.874	2.029	2.115	2.078	2.097	47	105.913	+ 6.589
Bournemouth Corporation ...	1.186	1.094	1.131	1.188	1.259	1.276	1.243	1.253	1.303	1.322	46½	77.896	+ 2.090
Bradford Corporation	3.840	3.890	3.909	3.987	3.993	3.892	4.098	4.249	4.268	4.061	47	215.346	+ 5,427
Brighton Corporation	598	626	627	679	650	633	645	655	684	668	47	41,707	- 3,119
Bristol	4.298	4.371	4.342	4.474	4.636	4.615	4.504	4.502	4.567	4.530	8	36.320	+ 120
British Elec. Trac. Co's. Undertakings													
Airdrie	213	198	212	219	203	207	225	218	218	215	7	1.639	+ 84
Barnsley	134	142	152	151	151	156	156	162	172	161	7	1.172	+ 99
Barrow	189	206	201	203	213	196	218	208	205	221	7	1.533	+ 42
Birmingham and Mid. Joint Com. :													
Birmingham and Midland ...	671	658	684	719	...	761	794	789	799	...	6	4.942	+ 503
City of Birmingham	2.571	2.432	2.434	2.600	2.591	2.639	2.707	2.716	2.753	2.674	7	19.263	+ 544
Dudley-Stourbridge	713	688	716	768	753	681	718	722	733	726	7	5.183	- 256
South Staffordshire	773	735	801	803	830	792	850	841	882	833	7	6.108	+ 259
Wolverhampton District ...	393	393	392	424	429	400	435	458	426	421	7	3.084	+ 58
Cavehill	47	44	51	47	46	55	52	56	67	63	7	419	+ 75
Devonport	388	400	383	398	412	409	408	407	400	406	7	3.072	+ 3
Gateshead	889	909	930	961	949	941	969	1.009	978	978	7	7.200	+ 355
Gravesend and Northfleet ...	176	183	185	195	161	172	183	184	189	183	7	1.345	- 84
Greenock-Port Glasgow	542	528	560	589	564	443	441	482	467	464	7	3.367	- 698
Hartlepool	207	225	239	240	241	214	229	217	218	213	7	1.643	- 46
Jarrow	90	86	92	96	97	96	97	96	105	97	7	726	+ 55
Kidderminster	79	80	79	88	82	76	87	80	81	87	7	598	- 13
Leamington	110	109	102	120	134	118	127	122	127	121	7	911	+ 19
Merthyr...	171	177	179	190	196	186	196	193	191	193	7	1.394	+ 44

(*Continued on page 214*).

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TRAFFIC RETURNS—*continued.*

TRAMWAYS AND OMNIBUSES.	1907. WEEKS ENDING. Jan. 26.	Feb. 2.	Feb. 9.	Feb. 16.	Feb. 23.	1908. WEEKS ENDING. Jan. 25.	Feb. 1.	Feb. 8.	Feb. 15.	Feb. 22.	Wks.	AGGREGATE. 1908.	Increase or Decrease.
British Elec. Trac. Cos.—*continued.*	£	£	£	£	£	£	£	£	£	£		£	£
Metropolitan Electric	3.255	3.292	3.387	3.365	3.647	4.347	4.570	4.694	4.839	4.633	7	33.827	+ 7.620
Middleton	269	250	270	282	280	261	274	311	307	307	7	2.143	+ 135
Oldham-Ashton	522	500	533	551	559	500	531	559	565	566	7	4.012	+ 63
Peterborough	84	91	92	96	97	94	99	100	102	105	7	735	+ 51
Potteries	1.605	1.788	1.706	1.714	1.837	1.785	1.902	1.727	1.749	1.708	7	13.600	+ 693
Rothesay	39	39	41	45	34	42	41	45	54	47	7	356	+ 45
Sheerness	45	44	45	46	50	46	44	46	47	48	7	339	+ 4
South Metropolitan	522	547	566	588	624	577	620	632	675	639	7	4.652	+ 148
Southport	174	191	188	189	199	167	179	192	190	187	7	1.352	- 72
Swansea...	725	700	713	764	746	754	814	890	794	821	7	5.941	+ 412
Taunton	31	32	36	35	40	34	36	34	34	35	7	259	- 2
Tynemouth	131	126	139	134	138	135	138	133	136	138	7	1.038	+ 16
Weston-super-Mare	31	23	22	23	23	29	25	23	26	22	7	170	
Worcester	206	205	207	218	220	214	226	245	226	228	7	1.676	+ 51
Wrexham and District	81	77	89	83	86	92	85	90	88	92	7	637	+ 11
Yorks. (Woollen) District ...	785	800	837	843	836	778	889	839	855	837	7	6.159	- 32
Burnley Corporation	1.085	1.050	1.070	1.066	1.090	1.169	1.103	1.166	1.112	1.066	8	14.784	+ 277
Burton-on-Trent Corporation ...	232	252	241	258	252	231	251	240	231	255	47	13.148	- 642
Bury Corporation	788	823	825	898	...	875	984	1.002	1.012	...	46	50.783	+ 6.260
Cardiff Corporation	1.748	1.794	1.725	1.841	1.849	1.860	1.913	1.864	1.866	1.947	47	99.743	+ 3.076
Carlisle, City of	119	133	126	140	137	142	154	140	148	152	8	1.177	+ 70
Chatham and District	527	560	553	603	625	549	582	619	597	605	7	4.301	- 178
Chesterfield Corporation	183	185	191	197	194	204	210	213	209	199	48	10.548	+ 600
Colne and Trawden	165	169	170	174	172	179	175	180	176	176	8	1.396	+ 24
Cork Electric	386	383	397	388	402	369	380	403	383	385	7	2.777	- 198
Croydon Corporation	1.030	1.067	1.096	1.133	1.186	1.115	1.200	1.192	1.232	1.195	47	65.337	- 1.328
Darlington Corporation	172	186	185	198	194	183	187	185	189	200	47	9.864	+ 38
Derby Corporation	617	653	641	713	672	701	719	731	790	794	47	36.395	- 1.310
Dover Corporation	149	161	160	161	162	138	145	142	143	151	47	10.251	- 1.268
Dublin and Lucan	80	87	81	89	87	92	89	94	99	102	8	686	+ 27
Dublin United	4.344	4.400	4.514	4.604	4.450	4.618	4.550	4.727	4.802	4.765	8	34.982	+ 826
Dundee City	976	951	985	1.001	1.015	1.068	1.058	1.090	1.123	1.088	40	45.987	+ 2.090
East Ham Corporation	721	758	738	831	817	759	820	792	771	799	47	42.195	+ 469
Exeter Corporation	212	215	213	229	237	226	231	226	230	243	47	14.152	+ 515
Falkirk and District	224	243	255	254	...	264	246	254	244	240	21	3.788	—
Glasgow Corporation	15.715	15.601	15.937	16.045	16.029	16.079	16.219	16.717	16.820	16.331	38	663.195	+ 18.961
Glossop (Urban Elec. Supply Co.)...	120	122	119	123	118	109	111	114	116	118	8	908	- 57
Hastings and District	632	631	634	691	736	650	691	752	707	778	8	5.660	+ 306
Huddersfield Corporation	1.297	1.309	1.356	1.397	1.380	1.363	1.390	1.437	1.670	1.389	47	73.831	+ 3.298
Hull Corporation	2.152	2.235	2.289	2.304	2.259	2.306	2.401	2.440	2.346	2.364	47	115.977	+ 6.507
Ilford Corporation	363	380	456	407	404	352	381	364	351	362	47	21.159	- 985
Ilkeston Corporation	109	111	120	127	115	121	125	126	122	123	48	6.708	+ 413
Ipswich Corporation	282	298	285	309	299	272	299	301	299	304	47	18.396	- 1.096
Isle of Thanet	173	192	185	211	219	197	206	210	231	224	8	1.648	- 27
Keighley Corporation	125	133	126	125	148	135	133	154	139	139	34	5.380	+ 313
Kilmarnock Corporation	141	142	150	144	138	134	143	142	140	147	40	6.350	- 149
Lanarkshire	951	926	953	1.022	1.006	1.223	1.140	1.181	1.235	1.224	7	9.146	+ 1.942
Lancashire United	989	934	1.016	1.023	1.032	1.080	1.039	1.129	1.147	1.153	7	7.967	+ 669
Leeds City	5.598	5.605	5,639	5.960	5.879	5.746	5.977	6.040	6,075	5.931	47	304.480	+ 12.763
Leicester Corporation	1.820	1.977	1.961	2.042	2.001	1.901	2.032	1.978	2.092	2.047	8	16.121	+ 195
Leith Corporation...	432	449	463	457	443	442	454	473	464	455	40½	21.025	+ 183
Leyton U. D. Council	733	772	756	796	828	744	797	807	800	816	47	47.287	
Liverpool Corporation	9.838	9.995	9.947	10.142	10.285	9.801	10.193	10.423	10.251	10.360	8	77.276	- 879
London County Council	24.057	24.885	25.360	26.983	27.051	28.211	29.829	29.670	29.852	29.822	8	1.460.058	+ 232.773
London General Omnibus... ...	16.171	16.845	16.458	17.801	17.524	15.656	17.236	17.327	17.769	17.501	8	137.120	- 4.918
London Road Car	5.856	6.229	6.296	6.731	6.683	6.161	6.738	6.818	7.104	6.876	8	45.194	- 3.889
London United	4.574	4.757	4.745	5.046	4.985	4.631	5.162	5.239	5.330	5.197	8	38.336	- 57
Lowestoft Corporation	122	127	124	135	131	126	137	137	139	145	21	3.380	+ 146
Maidstone Corporation	...	...	...	...	...	137	149	150	146	145	47	6.378	—
Manchester Corporation	12.535	12.566	12.959	13.416	12.884	12.984	13.561	13.828	13.828	13.691	47	688.655	+ 44.776
Nelson Corporation	113	118	121	129	125	125	119	130	128	120	47½	6.714	- 28
Newcastle-on-Tyne Corporation ...	3.692	3.808	3.843	3.890	3.898	3.725	3.889	3.826	3.753	3.709	47	191.045	+ 986
Newport (Mon.) Corporation ...	524	557	529	570	576	543	556	548	565	571	47	31.494	+ 2.083
Northampton Corporation... ...	321	326	352	361	380	351	368	379	365	380	45½	20.008	- 236
Oldham Corporation	1.537	1.675	1.677	1.693	1.685	1.516	1.858	1.785	1.828	1.753	48	91.845	+ 6.167
Portsmouth Corporation	1.224	1.277	1.305	1.317	1.335	1.376	1.412	1.426	1.465	1.438	47	89.834	- 712
Preston Corporation	620	601	609	644	661	683	632	663	668	659	8	5.286	+ 176
Provincial...	1.224	1.282	1.264	1.299	1.298	1.321	1.348	1.368	1.353	1.379	21	30.482	+ 1.287
Reading Corporation	501	511	516	536	537	512	541	526	558	546	46½	28.682	- 675
Rochdale Corporation	873	874	904	935	897	888	947	965	980	958	47	50.743	+ 2.589
Rossendale Valley...	167	169	169	169	191	172	179	176	182	178	8	1.379	- 34
Rotherham Corporation	465	466	504	534	549	566	567	587	600	578	46½	28.308	+ 4.505
Salford Corporation	3.841	3.971	4.180	4.131	4.064	4.021	4.225	4.304	4.303	4.224	47	216.761	+ 6.772
Sheffield Corporation	4.945	5.037	5.105	5.177	5.269	5.180	5.253	5.370	5.302	5.104	48	266.308	+ 11.638
Southampton Corporation... ...	752	732	770	787	823	873	876	898	876	897	46½	47.431	+ 2.980
Southend-on-Sea Corporation ...	221	201	215	234	253	232	233	248	263	253	47	18.256	+ 168
South Shields Corporation ...	432	435	339	468	453	474	478	478	477	486	47	26.464	+ 5.286
Sunderland Corporation	1.174	1.178	1.252	1.267	1.219	1.087	1.087	1.137	1.046	1.083	47	63.165	- 2.176
Swindon Corporation	133	124	128	132	147	137	129	145	137	138	—	—	—
Tyneside Tramways and Tramroads	362	349	366	366	383	358	346	369	365	359	8	2.557	- 78
Wallasey U. D. Council	675	680	683	708	704	686	701	725	712	727	47	38.798	+ 714
Walsall Corporation	443	459	471	492	455	477	516	514	514	511	8	3.775	+ 148
Walthamstow Corporation... ...	354	332	322	249	377	434	464	491	485	475	47	27.794	+ 1.748
Warrington Corporation	332	349	345	348	394	340	351	356	351	366	47	17.711	+ 612
West Ham Corporation	1.931	1.937	1.974	1,995	2.139	1.971	2.042	2,050	2.080	2.048	47	107.386	+ 2.197
Wigan Corporation	1.098	1.103	1,110	1.128	1,149	1.162	1.184	1.212	1,218	1.318	47	59.049	+ 4.203
Wolverhampton Corporation ...	705	715	745	762	742	738	805	758	744	809	47	43.070	+ 607
Yorkshire (West Riding)	904	911	975	1.093	981	960	1,077	1,142	1.137	1.000	8	8.372	+ 561
FOREIGN TRAMWAYS.													
Anglo-Argentine...	10.665	12.287	16.226	16.017	16.270	17.025	17.823	18.562	17.821	18.012	8	143.114	+ 20.470
Auckland ... ...(month)	...	10.478	...	...	...	...	12.187	...	...	...	4	13.891	+ 1.673
Bombay	...	1.991	2.075	...	...	...	2.334	2.419	...	...	5	12.683	+ 2.225
Buenos Ayres and Belgrano ...	3.462	3.776	3.482	3.675	3.622	3.376	3.562	3.806	3.554	3.645	8	29.225	- 43
B. Ayres Grand Nat. & New (Joint)...	5.353	6.649	...	6.613	6.526	7.275	7.642	...	7.581	7.790	7	53.737	+ 8.038
Calcutta ... ... Rs.	53.774	55.433	51.435	51.238	47.197	47.000	52.916	60.886	47.472	49.806	8	411.376	- 39.845
Kalgoorlie ... ...(month)	...	3.777	...	...	...	...	3.638	...	...	...	4	3.638	- 139
Madras ... ... Rs.	(2 weeks)	17.623	(2 weeks)	16.548	...	(2 weeks)	19.961	(2 weeks)	19.820	...	6	59.466	+ 8.040
Perth (W.A.)	1.509	1.562	1.502	1.505	1.494	1.472	1.490	1.422	1.430	1.453	8	11.059	- 777
Rio de Janerio ... ...(month)	...	96.190	...	...	...	...	112.008	...	...	...	4	112.008	+ 15.818
Sao Paulo ... ... (month) $	...	174.968	...	...	...	...	191.731	...	...	...	4	191.731	+ 16.763
Singapore ... ... $	9.435	9.013	8.799	12.126	9.258	8.808	9.786	11.205	8.709	9.494	21	193.533	+ 9.605
ELECTRIC RAILWAYS.													
Baker Street and Waterloo ...	2.420	2.340	2.245	2.410	2.430	3.120	3.185	3.035	2.950	3.020	8	24.820	+ 5.749
Central London	6.466	6.406	6.426	6.328	6.365	6.277	6.201	6.101	5.951	5.924	8	49.180	- 2.085
Charing X Euston & Hampstead ...	...	...	...	...	...	3.140	3.170	3.145	3.045	3.065	8	25.115	—
City and South London	3.203	3.085	3.150	3.121	3.002	3.537	3.372	3.331	3.238	3.216	8	27.275	+ 2.419
Great Northern and City	1.959	1.914	1.921	1.893	1.874	1.911	1.871	1.830	1.801	1.811	8	14.792	- 570
Gt. North'rn, Piccadilly, & Brompton	3.630	3.685	3.780	3.810	3.890	5.440	5.590	5.390	5.180	5.240	8	43.065	+ 13.706
Liverpool Overhead	1.300	1.312	1.332	1.318	1.384	1.330	1.368	1.405	1.396	1.432	8	11.004	+ 123
Mersey	1.801	1.800	1.781	1.748	1.790	1.931	1.862	1.881	1.852	1.838	8	15.222	+ 787
Metropolitan	15.034	14.885	14.633	14.634	14.789	15.170	15.099	14.751	14.676	14.636	8	121.914	+ 408
Metropolitan District	7.991	7.947	7.958	8.153	8.018	8.911	9.157	9.013	8.863	8.771	8	71.278	+ 7.179

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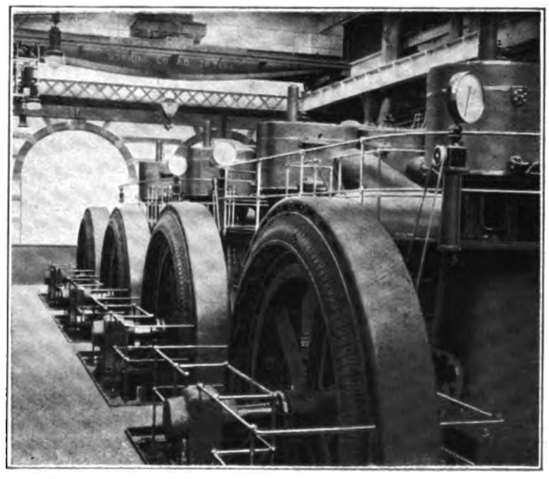

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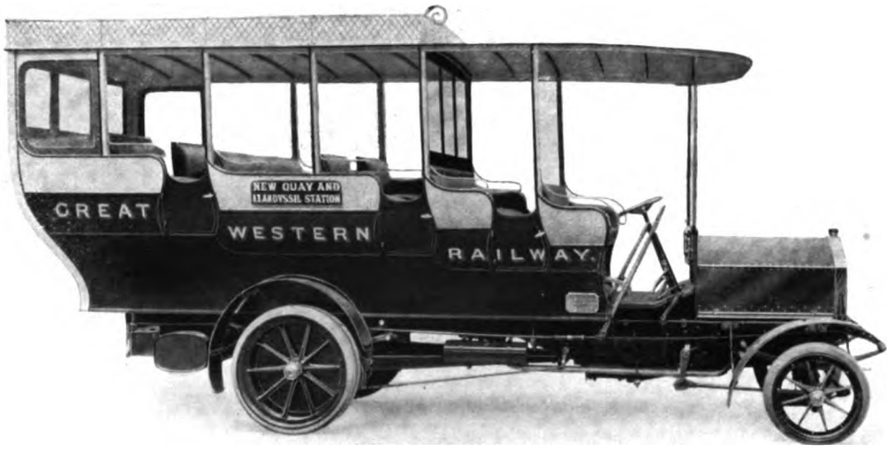

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AN OPINION "AFTER 16 MONTHS' CONTINUOUS RUNNING."

SILSDEN MOTOR OMNIBUS CO., LTD.,
nr. Keighley, Yorks., Nov. 13, 1907.

Dear Sirs,

With reference to the Motor Omnibus which you supplied to us in July, 1906, after 16 months' continuous running we are pleased to report to you that the good opinion we at first formed of your 'Bus has been more than justified by results, **and we congratulate ourselves in owning what we consider to be the best 'Bus on the market.** In consumption of Petrol and Oil she is remarkably economical. As to repairs your ledger will disclose that **our purchase of parts, &c., from you during the last six months have not exceeded £5,** which fact speaks volumes for the excellent workmanship of your Chassis. She requires a minimum amount of attention to keep her at concert pitch, and we can always depend on her carrying her complement of passengers (40) with ease up the long and steep gradients so numerous in this locality. We have nothing but unstinted praise for the manner in which your 'Bus has done its work on our country roads since July, 1906.—Yours faithfully,

p. pro **Silsden Motor Omnibus Co., Ltd.**
(Signed) M. P. CRYER, Secretary.

INSPECT OUR EXHIBIT AT OLYMPIA,

MARCH 27 APRIL 4.

RYKNIELD MOTOR CO., LTD.,

BURTON-ON-TRENT.

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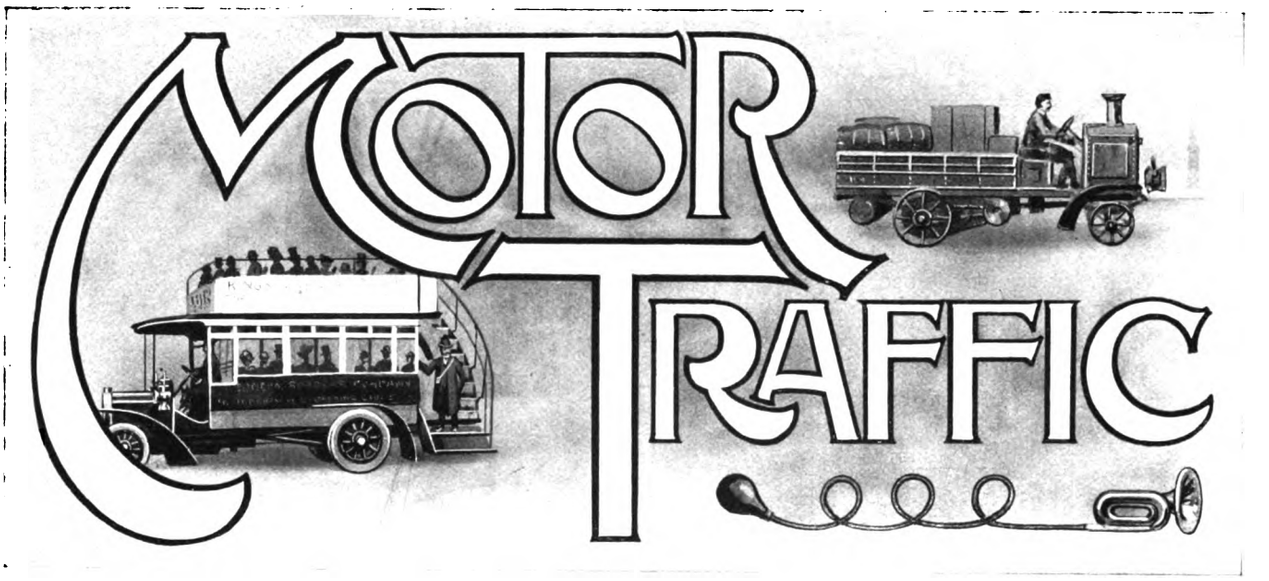

In a recent issue we referred to the rush which is taking place in providing motor cabs in the large towns throughout the country. Since then the pace has been accentuated, and within the last few weeks at least two big companies have been formed for the purpose of what is sometimes called "exploiting"—a word of disagreeable associations—the provinces. In addition, the local firms of cab-owners, job-masters and others all over the country are embarking in the motor cab business. One thing is certain to happen, and another is probable. The certainty is that many horse-cab proprietors, unless they are able to go vigorously into the motor business, will be left lamenting. The probability is that the companies and firms who are starting to run motor cabs are in for a period of disappointment as to financial results. Expectations appear to be far too largely based on the revenue per cab which is being obtained in London.

As a matter of fact, the receipts per cab per day cannot be expected, especially after competition is fully developed, to equal those at present got in London. The present metropolitan figures are bound to fall also as competition increases. But in other towns the cabs cannot expect to be as much employed as London cabs are, so that the receipts per day will be smaller. Some compensation, however, is to be anticipated from the fact that in "provincial" cities cab fares are as a rule higher than in London, and the motor cabs are to charge at the same rates as horse cabs. On the other hand, higher fares mean restricted use. A further feature is that the street surfaces in most towns are much rougher than those in London. This means greatly increased vibration, and hence greater cost of cab maintenance. We believe there is opportunity for a reasonable return on genuine capital outlay on motor cabs in the provinces, but investors should not look on the business as a gold mine.

The price of india-rubber continues to fall, and what is still more important there is evidently no prospect of a permanent return to anything like the prices which have ruled for several years. It begins to be almost certain that when existing contracts for motor 'bus tyre maintainence expire they will be renewed at a materially lower figure. The rate of two-pence per mile run with which we have been familiar cannot last, and a reduction of, say, a farthing, will make a great difference to the motor 'bus companies, causing those which are paying to be more prosperous, and enabling those which are in difficulties to weather their troubles. In this matter, too, time is on the side of the operating companies, as every year more and more india-rubber-producing plantations which have sprung into existence within recent years in tropical regions, will reach the producing stage. There are various hopeful prospects for the motor 'bus; this one is not the least of them.

The motor omnibuses running in Fifth Avenue, New York, are reported to be working satisfactorily. New York is, of course, well provided with tramways, but these are not allowed in Fifth Avenue. The opportunity for the omnibus thus comes in the same way as it does in the case of the west end of London; but though the New York avenues are long, one of them—paralleled by tramways and elevated and underground railways—does not of course present anything like the field offered by some of the districts of London. In Fifth Avenue horse 'buses used to be run, but motor vehicles were substituted last year. The chassis are of De Dion make, and have four-cylinder engines of 24 H.P. It is claimed that as the clutch used picks up the load gradually the 'bus can be started on the full-speed gear. How the New York people like the motor 'bus we are not informed, but as they are so much accustomed to railways—elevated, street, and underground—the vibration of an omnibus on the average quality of street paving in America must be somewhat of a new sensation to them. But—as has often been said—the American people will patronise all kinds of conveyances provided that they go fast.

A great deal of useful information for those interested in questions connected with the main roads of the country is contained in a paper on the commercial use of highways read by Mr. H. Howard Humphreys, before the Society of Road Traction Engineers. Among other matters dealt with was the cost of road maintainence, and copious statistics were presented to show how great had been the increase of expense per mile of road in recent years. The ratepayers in the counties, already burdened with other charges, are feeling the impost severely, and to that is added a sense of injustice, as they know that the increased cost is due to motor cars, lorries and tractors, the owners of which, in many if not most instances contribute nothing to the rates of the district. Mr. Humphreys

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MOTOR TRAFFIC.

advocates State subventions towards the maintenance of main roads; some people propose a heavier tax on motor vehicles, the proceeds of which should go into the local authorities' road funds. Perhaps a combination of the two plans would be most satisfactory. This whole subject, which is becoming more pressing every day, ought to be included in the new legislative proposals regarding motor traffic which the Government are contemplating. The cost of maintenance of town streets should also be brought within the scope of the reform, as the wear and tear from automobile traffic is a growing factor there also.

The claims of the petrol-electric omnibus were clearly set out in the paper read by Mr. Bernard Hopps before the Rugby Engineering Society on February 13. The abolition of change-speed gearing would be such a great advantage that even considerable disadvantages from petrol-electric or other systems might be comfortably endured. The most recent makes of change-speed gearing are wonderfully good, considering the inherent drawbacks of the system, and we cannot but think that the other system which has comparatively unimportant inherent drawbacks will come rapidly to the front. There should be a great field for a good petrol-electric 'bus, but we cannot be so sanguine as Mr. Hopps is with reference to the electric 'bus driven from accumulators. No doubt it is very well to speak of the batteries being maintained at a fixed contract rate by their makers; but if the manufacturers find that the rate does not pay they will want a higher rate, and then what becomes of the commercial success of the 'bus? Experience of that kind is far from new.

The importance, to the owners of motor omnibuses, and of other commercial motor vehicles using india-rubber tyres, of the question which came before Judge Woodfall, at Westminster County Court, on February 21, can hardly be exaggerated. The point arose in an action for damages in respect of a motor 'bus skidding, and so doing injury to certain privately owned lamp-posts. The Judge found that the defendants (the motor 'bus company) were liable for placing a nuisance on the highway, and for negligent use of the highway. It is satisfactory to know that leave was given to appeal. If the superior Courts confirm the view of the County Court Judge it will be practically impossible to run motor 'buses with the kind of tyre which the law requires—an absolute stultification for which some remedy must be found. The ingenuity of inventors of non-skid tyres will be whetted, and possibly a device which will meet with general acceptance may be evolved. Some of the non-skid tyres already on the market may be further tested, and whatever merits they have proved and improved upon.

HALLEY'S INDUSTRIAL MOTORS, LIMITED, of Yoker, Glasgow, have received an order from the Crown Agents for the Colonies for one of their 24 H.P. 2-ton chassis. The company have also received a repeat order from Mr. John Gibson, of Wishaw, for one 12-seated 20 H.P. public service wagonette.

A NEW PETROL-ELECTRIC 'BUS.—Messrs. Greenwood and Batley, of Leeds, have introduced a petrol-electric omnibus chassis of a new type. It is the outcome of extensive experiments, and has been running on the road for the greater part of the last twelve months. The engine is an ordinary four-cylinder petrol motor, which gives 35 B.H.P. when running at 900 r.p.m. It is connected with a four-pole, protected, continuous-current generator by a flexible coupling.

THE COMMERCIAL VEHICLE EXHIBITION.

Active preparations are now being made for the second International Commercial Motor Vehicle and Motor Boat Exhibition to be held at Olympia from March 27 to April 4. The plan for the laying out of the stands has been completed, and the ballots for places have taken place, whilst over 80,000 square feet of space have been allotted to intending exhibitors. These include the following firms: Argylls Motors, Clarkson, Daimler, De Dietrich, Dennis Bros., J. E. Hutton, James and Browne, Lacre, J. A. Lawton, J. Liversedge, Milnes-Daimler, New Arrol-Johnston, John I. Thornycroft, Wolseley, De Dion Bouton, Straker and Squire, Alldays and Onions, Armstrong-Whitworth, Maudslay, Sturmy Motor, Howes and Son, Belsize, Commercial Cars, Limited, Darracq, Darracq-Serpollet, J. and E. Hall, Austin Motor Company, Fiat Motors, Thames Engineering Works, Lindsay Motor, Horley Motors, Greenwood and Batley, E. H. Bentall, Atkey, Durham Churchill and Company, Halley's Industrial Motors, Hillman-Coatalen, and Valveless, Limited. All the best known tyre makers and components manufacturers will fill the gallery. There can be no doubt, in view of the immense development of the trade in commercial motor vehicles, that the second exhibition will prove even an greater success than that of last year. We append a few notes as to some of the probable exhibits.

BELSIZE MOTORS, LIMITED, Clayton, Manchester, will be represented by a four-cylinder 14-16 H.P. van which possesses many good features. The engine cylinders are of 3½ in. bore with a stroke of 4 in., the speed being 1,000 r.p.m. The three forward speeds and the reverse are all obtained by the movement of one lever. The wheel-base is 8 ft. 3 in., and there is a capacious body for goods and parcels.

BURGESS AND HARVEY, LIMITED, Glasshouse Street, Piccadilly Circus, London, will show White and Poppe commercial vehicle and boat engines, carburettors, etc.

C. BURRELL AND SONS, LIMITED, Thetford, Norfolk, will show a 5-ton compound steam tractor, a type which is favourably known for hauling heavy loads.

CLARKSON, LIMITED, Chelmsford.—The principal exhibit of this firm will be a large double-deck steam omnibus embodying several improvements on the type now in use. The wheel-base has been lengthened, the spring suspension is improved, and two extra bearings are provided on the crank shaft. The omnibus to be shown has run for 600 miles in hilly country.

THE DARRACQ-SERPOLLET OMNIBUS COMPANY, London, will have a fine display, consisting of no less than six of their steam vehicle chassis. One is fitted with a double-deck omnibus body built by Christopher Dodson Limited, this being the type supplied to the Metropolitan Steam Omnibus Company. Two chassis have lorry bodies, a fourth has a covered van body, while the other two chassis are shown without superstructure. One of these is suitable for an omnibus or van, and the other for a light delivery van. Except in the last case the engines are of 30-40 H.P.

DE DION BOUTON (1907) LIMITED, Great Marlborough Street, London, W., will have on view a small omnibus with a body made of steel, a 12-H.P. lorry, a polished omnibus chassis, and a 1-ton van.

CHRISTOPHER DODSON LIMITED, Westminster, besides being represented by bodies of vehicles on other stands, will themselves show a single-deck 'bus body of the type which they regularly supply to the Great Western Railway Company. The exhibit will also include one of their latest types of char-a-bancs, as supplied to the same railway company. In fact, both of these vehicles are part of a contract which the firm are at present executing.

THE DUNLOP RUBBER COMPANY, Aston, Birmingham, will have a large display of tyres, the chief exhibit being the company's solid motor tyre for 'buses and commercial vehicles. This is the type which is largely in use at present for omnibuses, vans, etc.

THE GRATZE PATENTS AND ENGINEERING SYNDICATE, of Whitfield Street, Tottenham Court Road, London, will show speed indicators and recorders, synchronised ignition apparatus, electric accumulators, magnetos, an air-valve sparking plug, and a new process of making aluminium alloy castings from steel moulds so that the castings require no machining. A variety of component parts of cars will also be on view.

MILNES-DAIMLER LIMITED, Tottenham Court Road, London, will have an extensive display, comprising five chassis. The vehicles include a Post Office van, a tip wagon suitable for a municipal cleansing department, a 2-ton box van which obtained a gold medal at the last reliability trials, a 5-ton pressed steel wagon, and a Great Western Railway omnibus.

THE POLACK TYRE COMPANY, Basinghall Street, London, of which Mr. F. Poppe is manager, will have an extensive display of their well-known tyres for motor vehicles.

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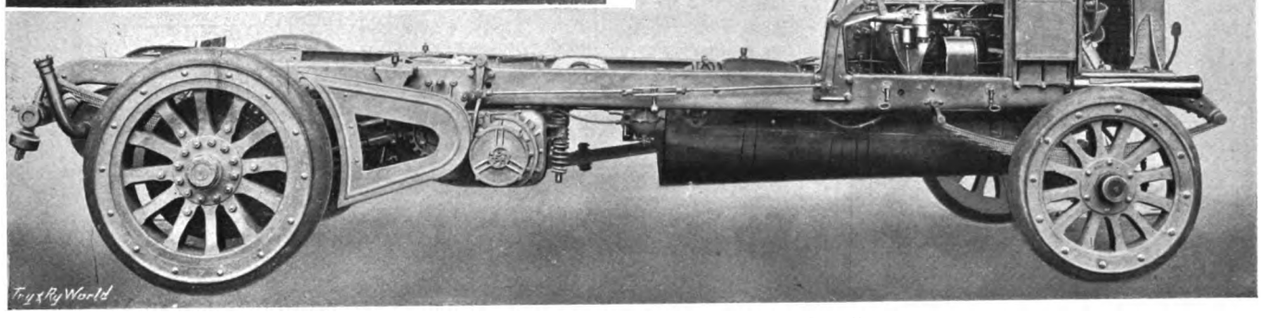
MOTOR TRAFFIC.

THE LONDON MOTOR OMNIBUS PROBLEM WITH SPECIAL REFERENCE TO THE PETROL ELECTRIC SYSTEM.*

By Bernard Hopps.

In order to meet the almost hysterical desire on the part of the London 'bus companies to purchase motor omnibuses, the manufacturers with practically no experience on which to base these designs, rapidly developed a vehicle, which, without being tested in service, was manufactured in large quantities, and as quickly sold. This fatally-rapid and abnormal development was soon to take effect, and the 'bus companies began to realise that the vehicles they had been so anxious to buy, were unsatisfactory for the duty required. In fairness to the manufacturers, it should be stated that the vehicles were not properly treated, they were driven at excessive speeds, and received but scant attention. The engineer in charge of them was instructed to keep as many cars on the road as possible, irrespective of the condition they were in.



British Thomson-Houston Petrol Electric Omnibus.

By this unfortunate mistaken policy, it was possible to shew for the time being certain profits, which were, however, produced at the expense of abnormally-rapid depreciation of the vehicles, and consequently heavy financial loss when the inevitable happened, and the bill for this depreciation had to be paid.

No doubt several of the older-established horse 'bus companies would have willingly dropped out at this stage, but for the fact that they had already committed themselves to the purchase of large quantities of vehicles, the delivery of which is still proceeding at the present time. What they actually did, however, was to make representations to the manufacturers, and induce them to modify their designs, in order to fulfil the remaining portion of their contract with a vehicle of a more satisfactory type. The manufacturer, in some cases, responded by strengthening certain parts, but the general system, which was at the root of the trouble, necessarily remained unchanged.

As a result of the keen competition in London between the various companies, the 'buses were driven at their maximum speed, they became very noisy, and especially on bad roads, they produced so much vibration as to cause complaints from the inhabitants of the houses *en route*. As a result of the complaints and protests which were raised Scotland Yard took steps to deal with the nuisance, and regulations were issued which still further handicapped the operating companies, and incidentally, as it ultimately proved, the manufacturers.

The foregoing will enable those who were previously not familiar with the facts to realise the difficult position that not only the 'bus companies, but also the manufacturers, find themselves situated. The latter have in some cases spent thousands of pounds in their endeavours to provide a satisfactory vehicle, only to find that the market has practically ceased to exist for the time being. It is generally admitted that the motor 'bus has come to stay, and that the demand for vehicles will re-establish itself, but it is not at all certain as to what the motive power or form of transmission will be ultimately adopted.

There are to-day over 900 motor 'buses in London, 85 per cent. of which are owned by the three principal companies. Many of the 'bus companies in London are at present handicapped with a fleet of more or less obsolete vehicles, which they cannot sacrifice owing to the enormous capital expenditure they represent, and yet which cannot be run at a profit owing to the heavy maintenance charges. How long this condition of affairs will last is difficult to say. The present vehicles cannot run for more than a few years before they will be reduced to scrap value, but in the meantime these companies are apparently not in the position to consider the purchase of new vehicles.

There seems to be, therefore, at the moment, an opening for new motor 'bus companies in London, who would have for their guidance the valuable experience that the older concerns have bought so dearly. By the employment of only one type of vehicle, the running costs would be materially reduced, and the whole system of maintenance could be greatly simplified.

The question arises, what is the most satisfactory type of vehicle for such service conditions as obtained in London? The available systems may be summarised as follows:

Steam.
Petrol engine with mechanical change-speed gear.
" " " hydraulic transmission.
" " " electric transmission.
Electric drive with accumulators.

Of the above systems, two have been extensively tried in London service, *i.e.*, steam, and the petrol engine with mechanical change-speed gear.

Steam *versus* petrol engine, as the prime mover, is a far-reaching subject, and it is not proposed to discuss it at length in this paper.

* Abstract of Paper read before the Rugby Engineering Society, February 13, 1908.

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MOTOR TRAFFIC.

Each has its advantages, depending on the service conditions and the amount of load to be carried. For net loads of five tons and upwards, it is generally admitted that steam is the more satisfactory; on the other hand, for loads of two tons and less, the petrol engine has the advantage. For vehicles carrying loads between the limits of two and five tons, in which category may be classed motor omnibuses carrying 34 passengers, the relative advantages of the two systems is a debatable point.

The last year or two has seen considerable advance in the design of the steam vehicle. The chief trouble in the earlier types was experienced with the steam generator, the burner, and the fuel and water feeds. These troubles have been largely overcome, and for motor 'bus propulsion the steam system of to-day is, more than ever, a serious rival of the petrol engine with mechanical change-speed gear. This is due not so much to the petrol engine itself as to the unsatisfactory operation of the system of clutch and change-speed gear commonly in use, which has not materially been improved upon, and which has been the principal objection to this type of vehicle. If manufacturers of petrol 'buses are anxious to retain their business in the face of the competition of steam, they will be well advised to turn their attention to a different type of transmission, by means of which the same smooth and elastic drive of the latter may be obtained without the disadvantage inherent to a steam generator. The forms of transmission referred to are the petrol-hydraulic and the petrol-electric systems, which may be said to give these results.

As regards the petrol-hydraulic system, several schemes have been proposed, some of which have been tested; but, as far as the author is aware, this system has not been subjected to a prolonged service trial on a London motor 'bus, and, therefore, little can be said of its practicability for that class of work.

During the past few years considerable attention has been paid to petrol-electric transmission, and several systems have been placed on the market. In studying these it must be remembered that the first aim in designing a 'bus for London service, should be to reduce everything down to the simplest possible form. The electrical equipment must be self-contained, and sturdily built. It must be so simple that it can be taken to pieces and re-erected satisfactorily by an ordinary fitter, who has no electrical training.

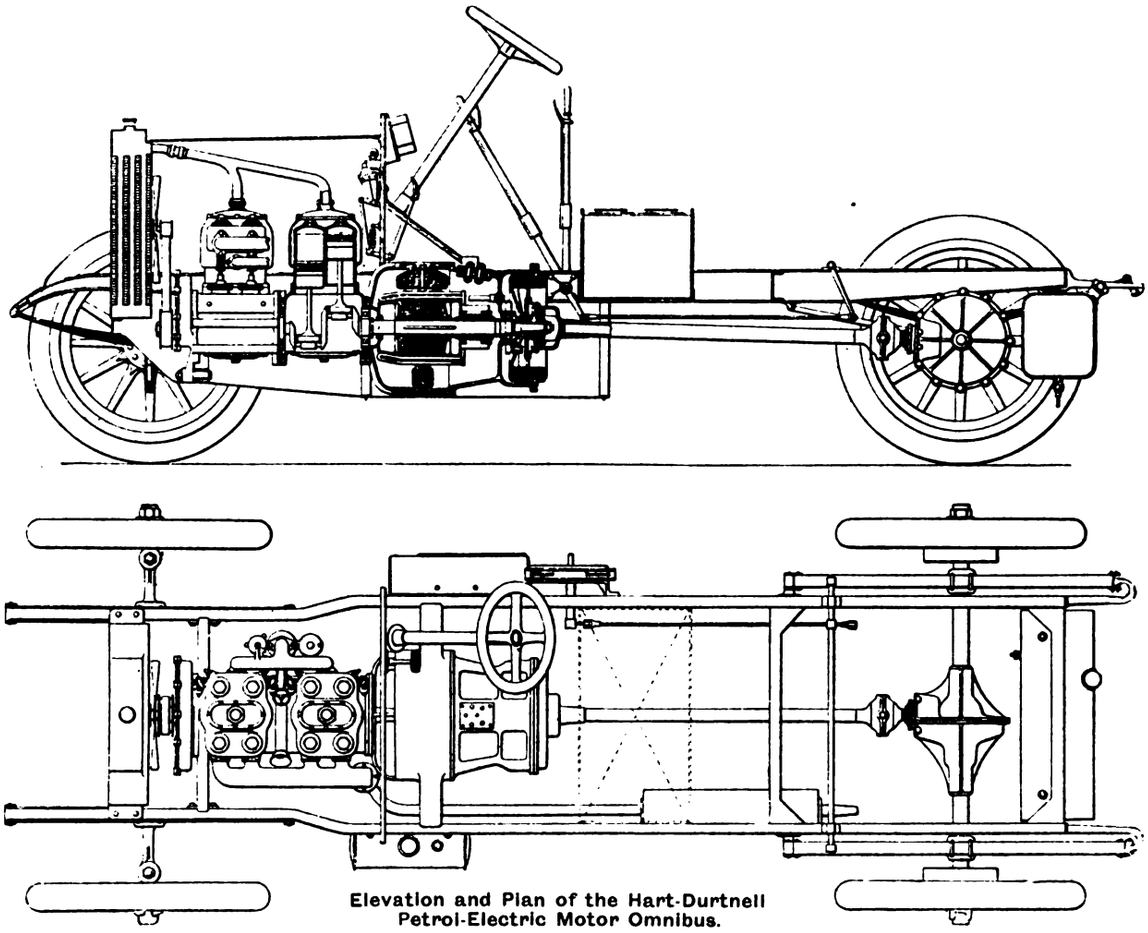
Petrol electric systems may be roughly grouped under the following headings:

(*a*). Those which start and accelerate electrically, after which the electric drive is cut out and is taken up by a clutch driving direct through from the engine.

(*b*). Those which employ accumulators to assist the engine in climbing grades, etc.

(*c*). Those which drive entirely electrically.

It is claimed for the first method (*a*) that since the electrical equipment is only used for starting and accelerating, it can be made comparatively smaller, lighter, and cheaper. This is an erroneous idea, as occasions will arise where hills of considerable length must be negotiated, the gradient of which will be too severe for the direct drive. Since such grades represent the most severe duty for the electrical equipment, it follows that in order to avoid over-heating, it must be made just as large and heavy as would be necessary were it called upon to propel the vehicle during the whole of the working period. Where traffic is congested, and where constant stops and starts are necessary, there is no real advantage in employing a direct drive to decrease the duty of the electrical equipment, since it cannot be used for sufficient length of time.



Elevation and Plan of the Hart-Durtnell Petrol-Electric Motor Omnibus.

It is further claimed for this system that the so-called direct drive at full speed is more efficient than a purely electrical transmission. Assuming that a few per cent. saving in efficiency may be obtained owing to the elimination of the electrical losses, which at full speed, however, are at their minimum, this arrangement introduces a clutch, which complicates the control and adds another item to upkeep. It also necessitates the alignment of the motor, generator and engine. It limits the speed of the motor to that of the engine, whereas with a purely electrical drive, the motor can safely be run at double the speed of the engine with a corresponding saving in weight and cost.

With regard to the second system (*b*) in which accumulators are used to assist the engine, it is somewhat difficult to see what advantage is obtained by their introduction; they add a complication, and require

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MOTOR TRAFFIC.

a special organisation to attend to them. The battery required is as heavy, and as costly as an electric motor would be, and far more expensive in upkeep. The simplicity of the control is sacrificed, and a skilled driver is essential to operate such a system efficiently. For heavy country service, in which long steep hills have to be negotiated the discharge rate on the accumulators is high, and there is the possibility that they may become totally discharged before the top of the hill is reached. The only advantage that can be claimed for such a system is that of recuperation during the braking and coasting periods.

There remains the third system (*c*), the pioneers of which in this country were the British Thompson-Houston Company. This consists of a direct-current dynamo driven by a petrol engine, the whole of the engine power being converted by the dynamo into electrical energy, which is transmitted through a controller to the motor, or motors, driving the road wheels. In this system, either one or two series wound motors may be used, depending on the nature of the service. For vehicles for service in London, the single motor with a single commutator is to be preferred, on account of reduced weight, cost, and simplification of the controller, although it necessitates the retention of the differential gear; for hilly country work, the double motor equipment, or its equivalent, is essential.

The chief feature of this system is the constant watt output auto-regulating dynamo, which reduces the control to its simplest form, and thus renders the employment of skilled drivers unnecessary.

In order to fully appreciate the advantages of this machine, it is necessary to study the characteristic of the petrol engine that drives it. The maximum H.P. that can be developed by a petrol engine is limited to practically its normal working output. The torque developed remains approximately constant; it follows, therefore, that as the speed diminishes, due to over-load, the H.P. developed diminishes, and this at the time when the maximum B.H.P. output is most required.

In the case of a gear-driven 'bus of the usual type, in order to provide sufficient torque at starting, it is necessary to introduce a comparatively large gear ratio between the engine and the road wheels. The vehicle is accelerated to a certain speed on this gear, which is then changed for one of a lower ratio, and so on until three or even four ratio changes have been made to bring the vehicle up to full running speed. Before each gear-change is made, the driving strain must first be taken off the teeth of the gear wheels. This is accomplished by withdrawing a clutch operated by a foot pedal, thus disconnecting the engine from the drive. It can be readily understood that a considerable amount of judgment and skill is required to effect each gear-change without noise or shock. It is small wonder the drivers become fatigued and careless at the end of a day's work, during which the gears are changed on an average some 800 times in London service.

The use of the auto-regulating dynamo eliminates the whole of this work and consequent fatigue, and its action may be described as follows:

At starting, the motors demand a large current in order to develop the necessary starting torque, the dynamo supplies this current, but at a very low voltage. As the motors speed up they automatically demand less current, which is supplied by the generator, but at an increased voltage. In other words, the voltage of the generator varies in inverse ratio to the ampere output, therefore the power required to drive it can never exceed a certain predetermined maximum, which is arranged to correspond to the maximum power of the engine. Whatever the current demand may be from the generator, it cannot cause an overload on the engine sufficient to reduce its speed and H.P. output.

As an example of the advantages of an auto-regulating dynamo, suppose a petrol-electric vehicle, fitted with such a generator, be running on a level road with the engine developing its full power, and with an output from the generator to the motor of 100 amperes at 150 volts.; now assume that a hill is encountered having a gradient of, say 1 in 15, since the engine is already developing its full power, and, in order not to overload it, the vehicle speed must necessarily diminish on the grade, at the same time the torque at the road wheels must increase. In order to produce the requisite torque to climb the hill, the motors will demand, say 200 amperes. Without any hand regulation or attention from the driver being required, the generator will deliver this current, but at 75 volts, the B.H.P. load on the petrol engine remaining the same, *i.e.*, 15 K.W. The vehicle will, therefore, climb the hill automatically, without the engine being overloaded, and which is even more important, without any action or attention on the part of the driver.

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MOTOR TRAFFIC.

Almost as important a feature in this system as the generator is the system of control, which has been reduced to the simplest possible form. By the use of the auto-regulating generator series-parallel control is rendered unnecessary, excepting for services including unusually steep grades. The auto-generator will supply all the current requisite for starting, accelerating, and for climbing ordinary grades, with the motors permanently connected in parallel. The controller proper is therefore reduced to a reversing switch of the simplest form. In order to stop the vehicle, the current is not interrupted at the main controller, but the voltage of the generator is reduced to zero by inserting a high resistance in the generator field, and at the same time reducing the engine speed. This is accomplished in practice by a single foot pedal, which is inter-connected with the engine governor, and a field rheostat, in such a manner that when the pedal is fully depressed the engine is governed to run at about 400 r.p.m., and at the same time all the resistance is inserted in the generator field, which is thus weakened to such an extent that the current ceases to flow to the motors, and the vehicle is stopped without breaking the main circuit. On releasing the pedal, the first movement cuts out the resistance, and the generator volts build up on the load, causing sufficient current to flow to the motors to start the vehicle, which will continue to run slowly, the engine remaining governed at 400 revolutions per minute. On entirely releasing the pedal, the governor is "held up," allowing the engine speed to at once increase to its normal value, and the vehicle to smoothly and rapidly accelerate to its full speed. To slow in traffic it is merely necessary to more or less depress the pedal, thereby reducing the engine speed, and consequently the generator voltage and the vehicle speed.

The same pedal is inter-connected with the lever operating the controller in such a way that it is necessary to first depress the pedal to its full extent before the controller can be operated; this ensures the current being reduced to zero before the main circuit is broken. No sparking can therefore take place at the controller, which can be made in the simplest form, without carbon breaks or magnetic blow-outs, etc. Owing to there being no question of alignment between engine and road wheels, the various units of transmission may be placed in the chassis in the best and most accessible positions. Lastly the electrical equipment by this arrangement is reduced to the lightest, and what is even more important, the cheapest form.

Before concluding, a few words must be said regarding the possibilities of accumulator traction for London and similar services. In view of the favourable costs for running petrol gear-driven 'buses that were quoted by leading authorities a few years ago, accumulator traction for this class of work was regarded as commercially impossible. Experience has shown that these costs were placed too low, and that the petrol 'bus costs at least 25 per cent. more to maintain than was at first anticipated. Skilled mechanics will not undertake the duties of a petrol 'bus driver, and the men who are employed are usually at a loss to rectify small derangements of the engine, etc., which often occur on the road, and therefore it is necessary to employ a staff of road adjusters, who are stationed along the routes to render skilled assistance in cases of breakdowns. Incidentally it may be said that the unreliabity of the present 'bus was at the root of the recent strike of the drivers of one of the largest 'bus companies in London.

In the light of the experience gained with the petrol gear-driven 'bus, the prospects of accumulator traction are much brighter. The accumulators themselves have been improved in detail, and accumulator manufacturers are now prepared to enter into contracts to maintain the accumulators at a flat rate per car mile, which at once relieves the operating companies of all anxiety as to the cost of their up-keep. Another important factor is the cost of the charging current, which has been considerably reduced during recent years, and can now be obtained at 1d. per unit, or even less. The operating companies should welcome the accumulator-driven 'bus, in which practically everything is reduced down to a contract price per car mile. Accumulator traction is admirably suited to London, as the streets are practically level, and the road surface for the most part paved. The absence of noise and smell would also go a long way to popularise the system.

The constant voltage of the battery would limit the maximum speed of the vehicle on the level, and in this way would prevent the dangerous racing which is often indulged in by drivers of petrol 'buses belonging to competing companies. The weight of an accumulator-driven 'bus is not more than between 10 to 15 per cent. heavier than the present petrol gear-driven 'bus, and it is capable of running 35 to 40 miles on one charge.

Liverpool Motor Cabs.—A service of motor cabs organised by Mr. J. T. Lawton was begun in Liverpool on February 10, when 25 vehicles were put on the streets.

RYKNIELD LORRIES AND 'BUSES.

The accompanying illustration shows a standard 5-ton lorry recently supplied by the Ryknield Motor Company, Burton-on-Trent, to Messrs. Hancocks, brewers, Cardiff. The engine is designed to use the cheap petroleum fuel which was employed on the Ryknield 5-ton vehicle which ran in the last commercial vehicle trials. The lorry is giving, we are informed, much satisfaction to his owners.

The Ryknield Company have completed a trial with one of their standard 40-50 H.P. motor 'buses in the service of Rawtenstall Corporation. As a result the Corporation have accepted the vehicle, and have ordered another of similar construction. During the trial not the slightest trouble was experienced with the 'bus. It ran on hilly routes, and the petrol consumption averaged a gallon to fully six miles. In view of the gradients and heavy roads owing to rain, this fuel consumption is very satisfactory.

MOTOR OMNIBUS NOTES.

Horse Cab Taximeters.—The Federation of Associated London Cab Proprietors have placed an order with the General Electric Company, for 1,000 "Aron" taximeters for horse-drawn cabs. A beginning was made during February with placing cabs with these meters on the London streets.

Nuneaton Omnibus Company.—This company has been registered with a capital of £1,500 in £1 shares, to carry on the business of motor car, omnibus, van and cab proprietors and manufacturers, carriers of passengers and goods, etc.

Messrs. Milnes-Daimler, Limited, of Tottenham Court Road, London, are now delivering 14 motor vehicles to the Federated Malay States. They are each fitted with their standard 3-ton chassis, the bodies being of various types. This firm have also in hand two single-deck omnibuses for British Guiana, designed for passenger and mail service. These have the latest Milnes-Daimler 22 H.P. chasis. The motor has 4 cylinders developing 23 B.H.P. at 800 revolutions, the cylinders being 100 mm. by 140 mm. stroke.

Tickets for Motor Cabs.—The General Motor Cab Company, London, have, it is announced, completed arrangements for issuing books of tickets in place of the system of paying the cab driver in coin. The pages of the book are perforated in squares, these representing sums of twopence and upwards. The habitual user of the company's cabs can buy a book of tickets, and on each occasion that he has to pay his fare he tears out as many squares as represent the sum and hands them over to the driver. A reduction of 5 per cent. is allowed for this payment in advance.

Motor Taxation and Road Maintenance.—The Motor Union, through a deputation to the Chancellor of the Exchequer, have urged on the Government that in any increased taxation of motor vehicles the money should go to a central fund and be distributed as grants in aid to local authorities for the purpose of highway maintenance. Following this up, the Union have circulated throughout the country a petition for signatures. Its prayer is to the same effect, and it is addressed to the Government. The signatures are to be returned by March 25 to the Motor Union, 1, Albemarle Street, Piccadilly, London, W. It may be noted that while the Union are not opposed to a small additional tax on pleasure cars, they think the taxation on

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MOTOR TRAFFIC.

public service vehicles is already heavy enough, and should not be increased.

TROUBLE FROM BACK-FIRING.—At Southwark County Court on February 17, Messrs. Sainsbury, provision merchants, sued the London Road Car Company and Messrs. J. Cooper and Company for £79 10s. for the loss of a horse. The case for the plaintiffs was that one of their two-horse vans was being driven along Bow Road when a motor 'bus belonging to the Road Car Company back-fired. The noise startled a horse belonging to Messrs. Cooper, and it swerved with the result that one of the shafts of the van it was drawing penetrated the flank of one of the plaintiffs' horses, causing such injury that the animal had to be killed. The Road Car Company denied the back-firing. The jury found for the plaintiffs against the Road Car Company for the sum claimed, and in favour of Messrs. Cooper. The plaintiffs were ordered to pay Messrs. Coopers' costs on the ground that they ought not to have been made defendants.

TRAMWAY AND 'BUS COMPETITION.—The Great Eastern London Motor 'Bus Company early in February began running a service of motor 'buses between Stratford and Ilford, competing directly with the Ilford municipal tramways. The Ilford Tramways Committee at once rose to the occasion, ran a more frequent and faster service of cars, and increased the length of the penny stage. The tramway receipts showed a falling-off, and no doubt the working expenses are higher. The Committee, however, are determined to do everything possible to retain their traffic, and if the 'bus company continue the struggle it must prove a losing concern for them The tramway may be expected to run the 'bus off the road, unless the latter also serves a good district not reached by the tramway. In addition to that, the municipal undertaking conducted under Parliamentary powers must be continued, while the omnibuses can be taken off whenever the company are tired of losing money on them.

HEAVY DAMAGES AGAINST A 'BUS COMPANY.—In the King's Bench Division on February 15, Mr. M. H. Hemple sued the London Road Car Company for damages for personal injuries alleged to have been caused through the negligence of defendants' servants. The plaintiff's case was that on May 9 last, while riding a bicycle near the Marble Arch, he was knocked down by a motor 'bus belonging to the defendants. The injuries he sustained were so serious that his left leg had subsequently to be amputated. As a consequence of the accident he pleaded that he had suffered a loss of profits in his business. The defendant company denied negligence and pleaded contributary negligence, and their case was that the accident arose through the plaintiff attempting to pass between the 'bus and the other traffic when there was not sufficient room. The jury found for the plaintiff, damages £750.

RESILIENT ROAD WHEELS.—The Atlas Engineering Company, Levenshulme, Manchester, a firm which have for some time past been specialising in the manufacture of resilient composite road wheels, have secured a repeat order for their wheels from the Vanguard Motor Omnibus Company to be fitted to Milnes-Daimler 'buses. Among other firms who have adopted these wheels are the Daimler Motor Company, Limited; the Bristol Carriage and Tramways Company, Limited; the Wolseley Tool and Motor Car Company, Limited; the Great Central Railway; Argyll Motors, Limited; and the Great Eastern London Motor 'Bus Company. One of the great advantages of this particular production is that the body of the wheel being one complete steel casting, with hollow spokes, there is no possibility of shrinkage, the cause of much trouble experienced by the use of wooden wheels. This company have recently designed a resilient wheel suitable for use on tramways, for which it is claimed that they possess the excellent quality of silent running.

LIABILITY FOR SKIDDING.—An important question was raised by a decision of Judge Woodfall in Westminster County Court on February 21 in an action, Gibbons *v.* the Vanguard Motor Omnibus Company, in which the plaintiff, who is lessee of the Holborn Empire Music Hall, claimed for damages done to three standard lamps outside his premises by a skidding omnibus. The Judge held that a vehicle on the roadway had done damage on the footway, and the onus was shifted to the defendants. The motor omnibus was duly licensed to ply for hire, it was submitted, and the driver was not guilty of negligence, as the omnibus was on a greasy road and skidded. A motor omnibus was liable to skid, and when skidding it was impossible to control the movement. He found that the defendants ran on the public highway a vehicle with knowledge that the surface of the roadway was in a condition likely to cause the vehicle to become out of control and a source of danger and injury. He was of opinion that the defendants were liable (1) for placing a nuisance on the highway; (2) for negligent use of the highway. The fact that the vehicle was licensed to ply for hire did not, in his opinion, absolve the defendants from liability. He gave judgement for the plaintiff, and granted leave to appeal.

NEW MOTOR CAB COMPANIES.—The prospectus was issued on February 12 of the Provincial Motor Cab Company, Limited. The capital is divided into 300,000 preferred ordinary shares of £1 each, and 60,000 deferred shares of 1s. each. Of the preferred ordinary shares, 260,000 were offered for subscription. They are entitled to a non-cumulative preferential dividend of 7 per cent. and one-half of the net profits remaining, after carrying 10 per cent. thereof to a reserve fund, the other half of such balance being payable to the holders of the deferred shares. The company intends to supply the principal provincial cities of Great Britain with an efficient system of taximeter motor cabs, and to take over certain contracts for options to purchase 250 Darracq cars, 100 Charron cars, and 100 Siddeley cars. Of these 450 cabs, 80 are ready for delivery and available for immediate service. The cost to the company of the whole of the cars will be £188,000, and, after payment of this amount, there will remain from the proceeds of the present issue and the deferred shares £75,000, which will be available for the purposes of garage, workshops, working capital, etc. The bodies of all the cabs will be so constructed as to accommodate four passengers and luggage. It is estimated that each cab should return a profit of 16s. per day, or £108,000 per annum for the 450 cabs, which is reduced to £73,000 by allowances for rent of taximeters, depreciation (sufficient to write off cost of cabs in six years), etc.—Another company, called the Metropolitan and Provincial Cab Company, Limited, has been formed with the intention of working in the provinces. It has given an order for 200 chassis to the Mass Motor Company, London.

AN ANTIQUATED CHARGE.—An interesting case came before Harrogate Police Court on February 18, when H. G. Burkett, a driver in the employment of the Harrogate Road Car Company, was charged with an offence under the Locomotives Act, 1865, with driving a locomotive at a greater speed than two miles an hour. For the prosecution it was stated that the police felt bound to take action if they considered that the law was being infringed. The charge was brought under section 4 of the Act of 1865, in which it was stated that it was not lawful to drive a locomotive along any turnpike road or highway at a greater speed than four miles an hour, or through any city, town, or village, at a greater speed than two miles an hour, and any person acting contrary was liable to a penalty not exceeding £10. In the Locomotives Act of 1896 it was provided that the restrictions should not apply to any vehicle propelled by mechanical power if under five tons in weight unladen, and providing it was so constructed that no smoke or visible vapour was emitted, except through temporary or accidental cause. The facts of the case were that on January 15 the defendant was driving a car at about six or seven miles an hour, and there was emitted a quantity of steam from the funnel and from the exhaust. The car had been under observation for ten days before, and steam was emitted from day to day, and it could not be said to be a temporary cause. Police evidence having been heard, the case for the defence was taken. The argument was that the charge had been brought under an obsolete Act, which had reference to traction in relation to the man with the red flag in front. The whole matter turned on the question whether the vehicle was a motor car. In the course of evidence, Mr. Thomas Clarkson, the manufacturer of the 'buses, said that one of the Harrogate 'buses had run in London without any police complaint being made. The reason that most of the cars emitted steam was because the service was not yet properly organised. The case was dismissed, each side to pay their own costs. The bench held that the emission of steam was temporary and remediable.

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THE Tramway & Railway World
A REVIEW OF CURRENT PROGRESS IN ELECTRIC AND OTHER TRACTION

ESTABLISHED 1892. LONDON, APRIL 2, 1908. VOL. XXIII.

THE COMPLETION OF THE FIRST TRAMWAY SUBWAY IN LONDON.

THE MISSING LINK IN THE LONDON COUNTY COUNCIL'S TRAMWAY SYSTEM.

The extension connecting the subway under Aldwych with the tramways on the Victoria Embankment has now been completed, and a service of single-deck cars will be provided from the extreme north of London over Westminster Bridge to Kennington Gate and to the Tower Bridge. When the lines have been laid over Blackfriars Bridge, the "cocked hat" at Waterloo Bridge will practically be the junction for the three through routes, north, east, and west. Should it, however, be found desirable to turn back any of the cars, the base of the "cocked hat" could be used for that purpose, while the through traffic went round the other two sides of this triangle. All these matters have no doubt been carefully considered by the chief officer, and it will be interesting to note how this unique arrangement will work in practice, for it has not been conclusively proved that a service of single-deck cars is not the most efficient in the end, especially with increased speeds.

In our issues of June 9, 1904, and January 11, 1906, we described and illustrated the subway which had been constructed under the new thoroughfare of Kingsway as far as the north side of the Strand, and we gave the longitudinal section right on to the Embankment. The dead end of the subway between the Strand and the first station in Kingsway has so far been used as a cross-over, and as a depôt with inspecting pits, etc. In our issue of January 10, 1907, we described the double junction—a plan of

The Entrance to the Subway with Conduit Tramways under Construction.
(As seen from Waterloo Bridge.)

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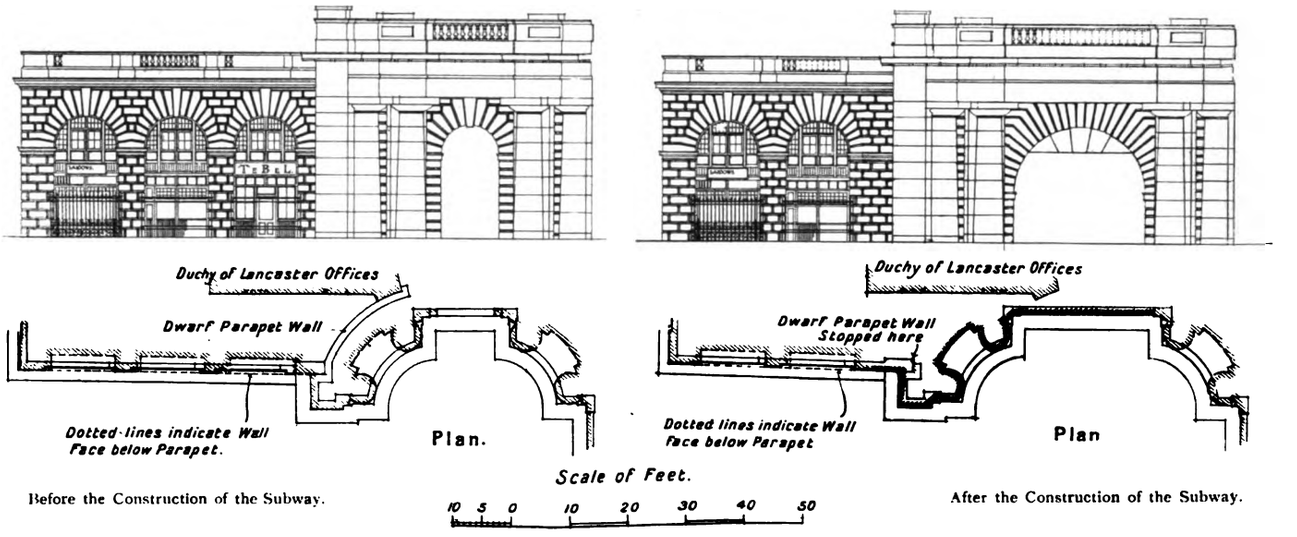
which is given below—between the Embankment lines and the subway right into the opening under the western wing-wall of Waterloo Bridge. It is this junction which has been termed the "cocked hat." The special structure over the District Railway and the points and crossings at the mouth of the subway were not constructed until after the length from the north side of the Strand had been sanctioned.

The new work now to be described is, therefore, only about a furlong in length, but it has cost between £50,000 and £60,000, or more than the whole length of the line between York Road, Lambeth, and John Carpenter Street; this works out to about £80 a foot run, or half a million a mile, which, under all the circumstances, must be considered a moderate price. The subway is entirely under Wellington Street, and the approach to Waterloo Bridge, both of which are subject to the jurisdiction of the London County Council, so that, beyond meeting certain requirements of the Duchy of Lancaster and of the Somerset House Authorities, which, however, added considerably to the trouble and expense, no compensation had to be paid and no land had to be acquired.

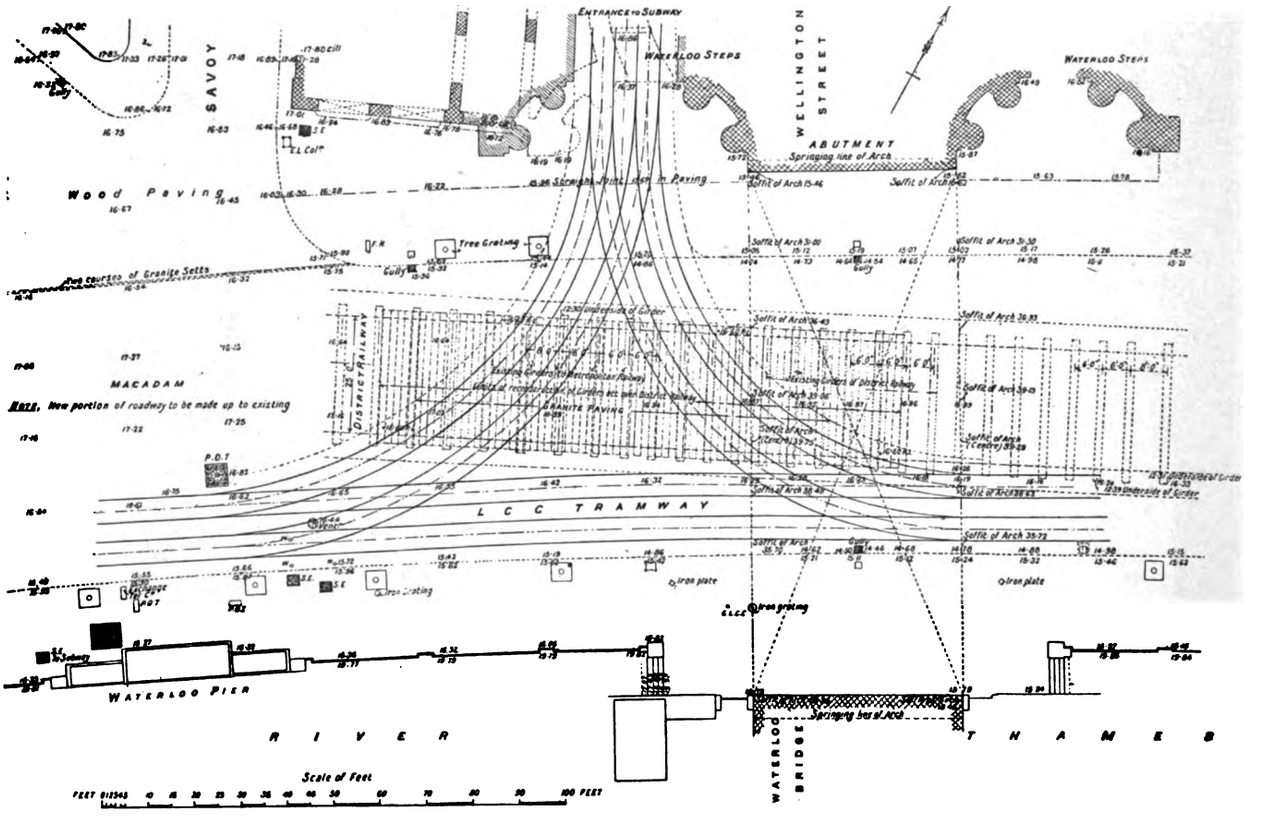
The longitudinal section in our issue of June 9, 1904, shows a down gradient of 1 in 20 between



Before the Construction of the Subway.

After the Construction of the Subway.

Elevation and Plan of the North West Wing Wall of Waterloo Bridge.



Plan of the Double Junction on the Victoria Embankment at the Entrance to the Subway.

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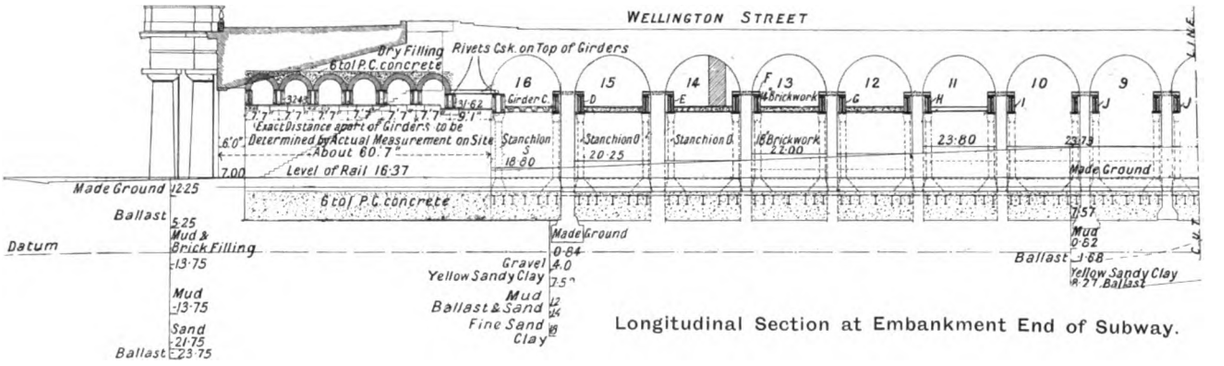
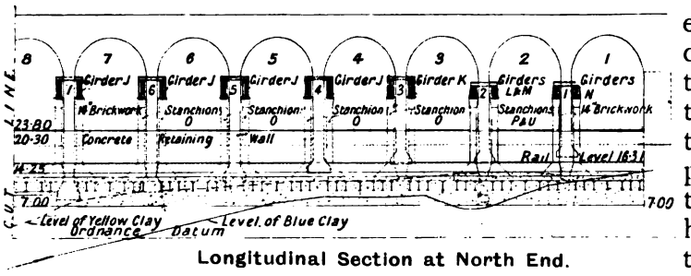
Kingsway and the Strand; then comes a short down grade of 1 in 108·30 under the Strand, and a level length of line about 500 ft. long right on to the Embankment; this piece of level minimises the danger of any runaway down the steep grade. The portion of the subway from the Gaiety Theatre to about one-third of the way down Wellington Street consists of two



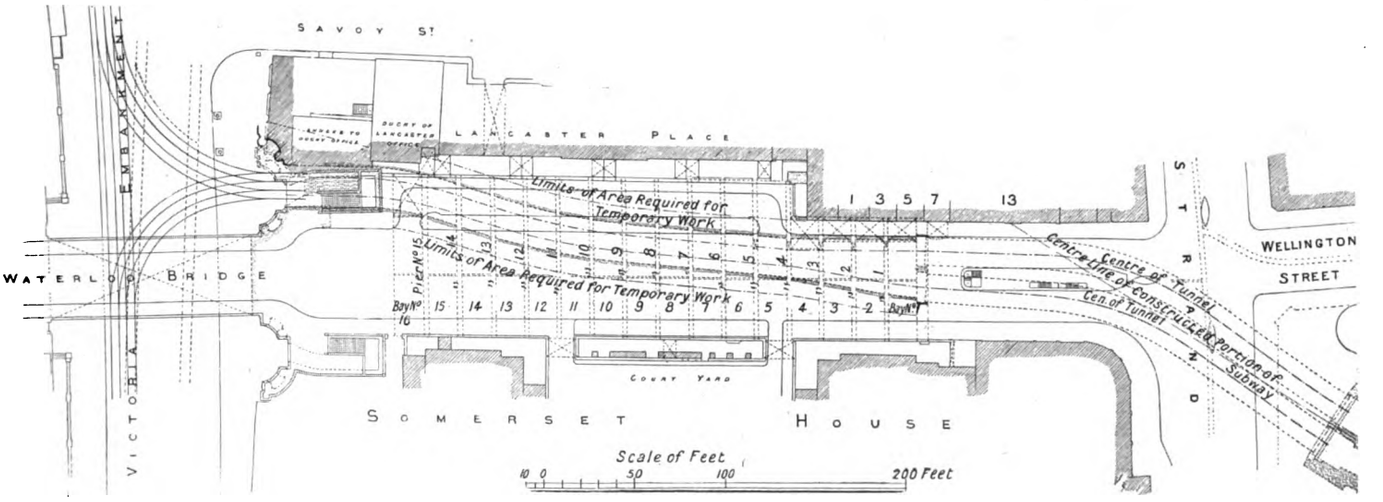
Longitudinal Section at Embankment End of Subway.



Longitudinal Section at North End.

pieces of straight joined by a gentle curve, and is laid in separate single track tubes, which were constructed by the help of the Greathead shield used under Holborn, and they are similar to those tubes. From here to the end the tunnel is constructed for a double line with a crossover near the centre of the length. From this point a gentle S curve leads to a short bit of straight at the mouth. The permanent way on the single and down line portions is similar to that fully described and illustrated in our issue of January 11, 1906, as laid down under Holborn and in the remainder of the subway respectively. As soon as the rails reach the Embankment the permanent way follows the design of the lines thereon as described in our notice of January 10, 1907.

The approach road of the bridge along Wellington Street is supported by a series of brick arches, on piers of the same material, floating for the most part on mud by means of a timber grid. This was found to be in such excellent condition that not a single crack was discovered in the whole of the structure. As the foundations of some of the piers were above the level of those of the new work, it is evident that the piercing of a large hole through these piers, and the necessary underpinning was a very ticklish operation; but so carefully and skilfully has this been done that the brickwork is not disturbed in any way, nor has any settlement whatever taken place. It was found that the massive wing of the bridge rested on an old river wall; owing to the wing wall having to be extended to make room for the large arch, which takes the place of the one over the steps (now done away with) the new work projected beyond the old river wall and three large screw piles have been driven to support the lengthened wing wall. The appearance of this wing has, if anything, been improved, and most of the huge granite blocks were used again, but had to be supplemented with additional ones; these, until begrimed by London smoke and dirt, will present a rather patchy appearance.



General Plan of Subway from Embankment to Aldwych.

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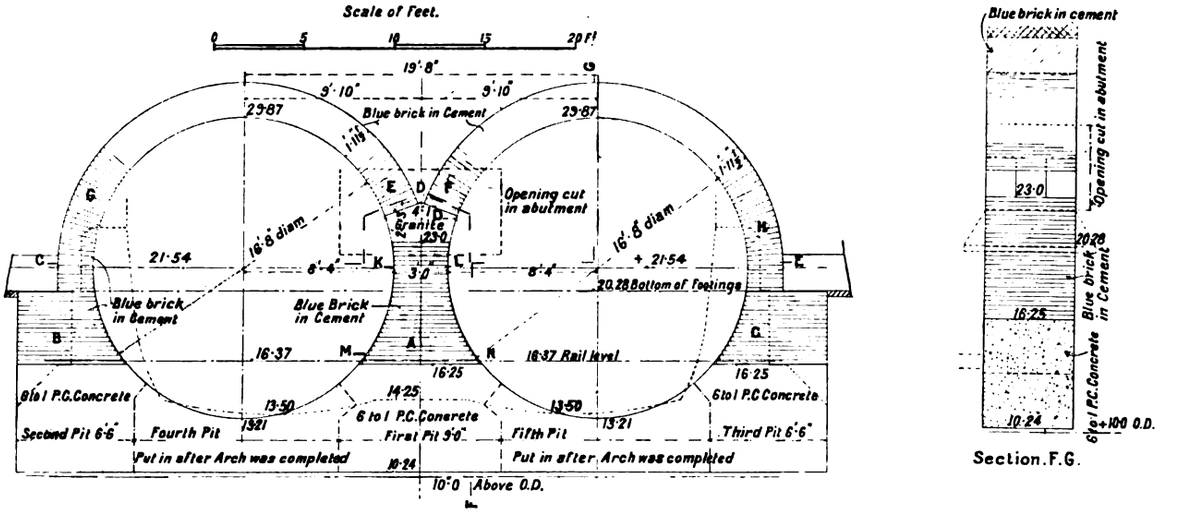
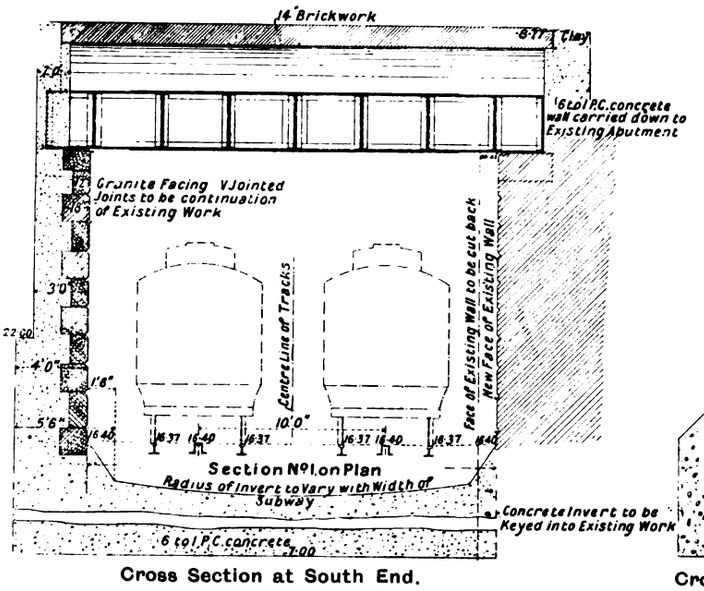
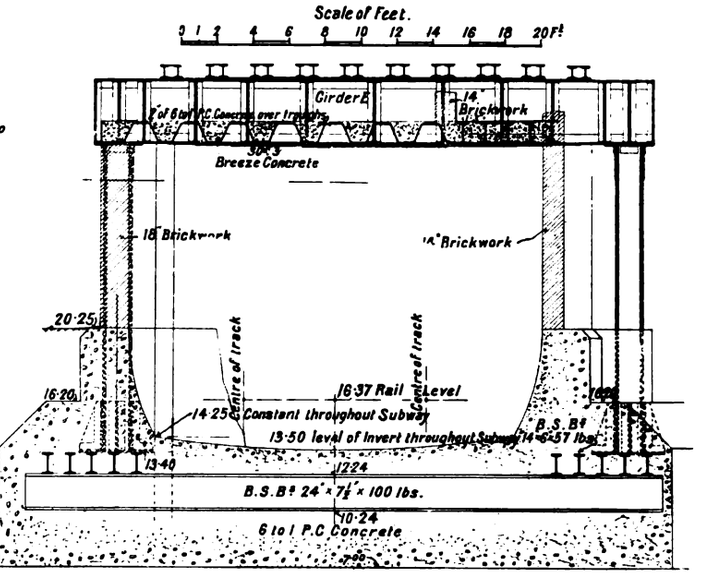
The plans and sections reproduced give a very good general idea of the massive construction of this short piece of work. It will be seen that on leaving the old brick arches and for a length of about 60 ft. the overhead construction is altered, and that the whole of the work rests on a massive raft of concrete reinforced by deep joists. In order to cut the holes through the old brickwork for the subway, stanchions were first erected on each side of the piers. On the top of these the main girders were fixed parallel to the piers. At the level of the top of the cross girders needle joists were passed through holes cut for the purpose resting on the cross girders,



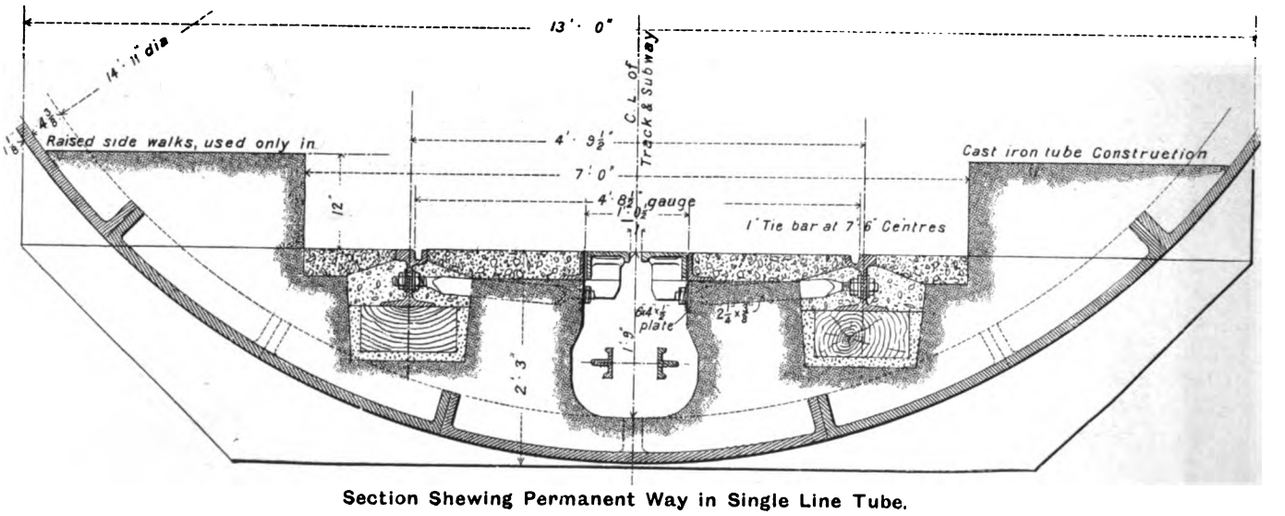
Abutment under Wellington Street, Shewing Method of New Construction.



Cross Section at South End.



Cross Section at Arches Numbered 1 to 16 on Longitudinal Section.



Section Shewing Permanent Way in Single Line Tube.

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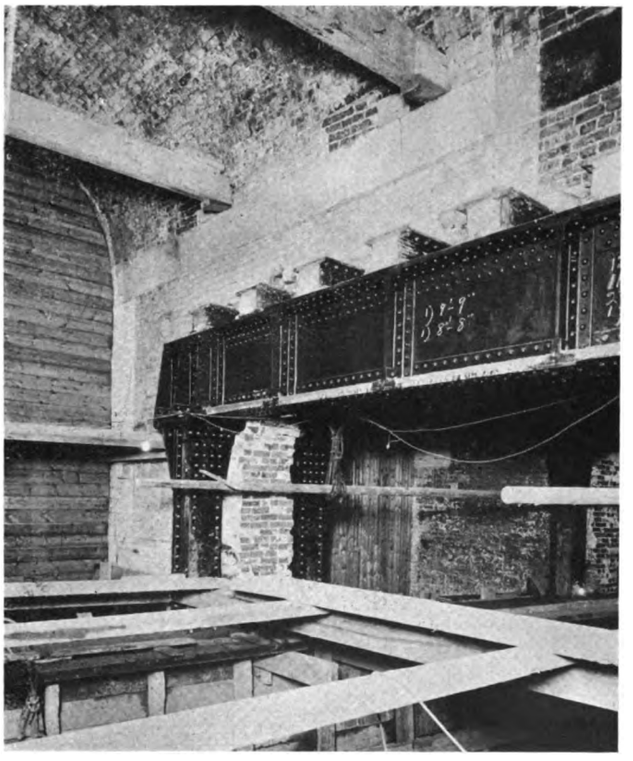
and just below a stone course forming the springing of the arches. The raft of concrete already mentioned formed the foundation of these stanchions and of the old brickwork piers where

Aldwych Station in Subway.

their footings were above it; these all rest on longitudinal joists laid on top of those reinforcing the concrete. All this work had to be done very gradually and carefully before the old

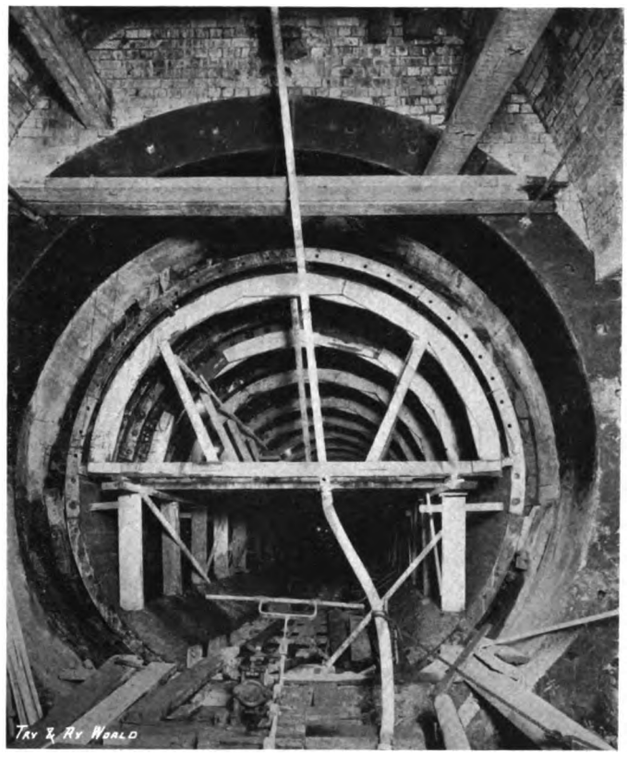


The Entrance to the Subway Under Construction.

supports to the brick arches could be cut away entirely. The spaces between the piers are covered by ceilings level with the top of the stanchions, partly of corrugated troughing and partly of concrete strengthened by expanded metal between the reinforcing joists. The invert of the subway was carried up the sides so as to form a retaining wall for a certain height, above which a brick wall was built up to the ceiling, so that the subway is cased in all round.

It is evident that had any portion of the old work been allowed to collapse the whole of Wellington Street would have subsided on to the mud beneath, and the effect on the buildings lining the street would have been disastrous. No doubt the untouched portion of the old brickwork will have to be watched to see that the increased vibration due to the tramway traffic does not affect it injuriously; though, seeing that it has successfully borne the very heavy and ever-increasing road traffic without showing any signs of weakness, there is every probability of its standing up to the new conditions without injury.

Work on this link was begun just about twelve months' ago, and has been carried out by the Works Department of the London County Council under Mr. G. H. Humphreys. The Cleveland Bridge Company, of Darlington, supplied the ironwork; the resident engineer-in-charge was Mr. F. O. Stanford, and the immediate supervision of the construction work was under Mr. W. C. Copperthwaite, and of the track work under Mr. T. C. Way; while to Mr. Maurice Fitzmaurice, C.M.G., the chief engineer



Single Tunnel Under Construction.

to the Council, is due the credit of designing and successfully carrying out the whole work. Mr. A. L. C. Fell, chief officer of tramways, is, as usual, responsible for the cars and equipment, while the laying of the cables and other electrical work has been under the charge of Mr. John Rider, the tramways electrical engineer.

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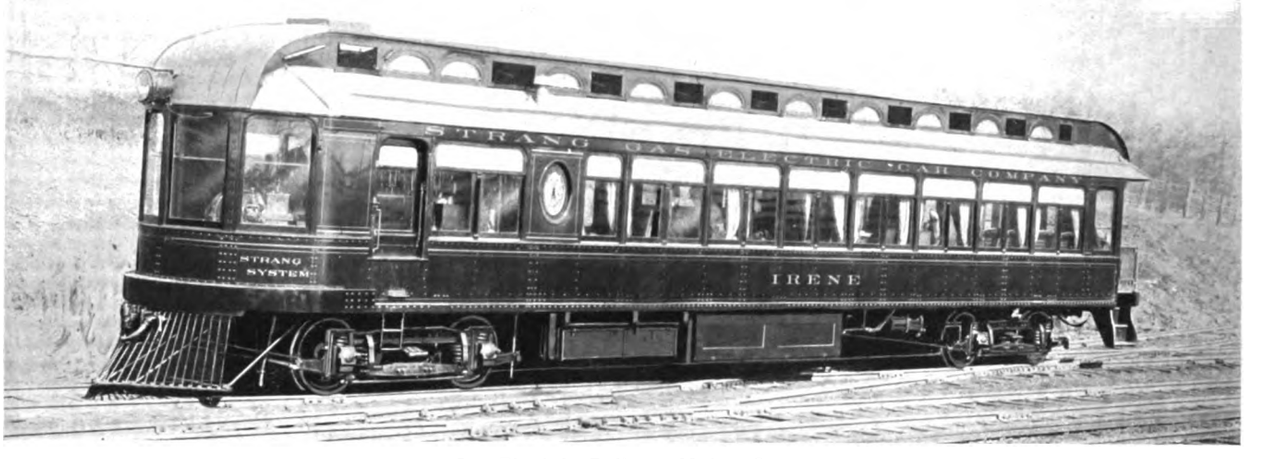
THE STRANG GAS-ELECTRIC SYSTEM.

An interesting rail-motor car has recently been completed at the works of the J. G. Brill Company for the Strang Gas-Electric Car Company. The car will make trips over all the main steam lines east of the Mississippi River, stopping at the principal cities for parties of railway experts, who will inspect the car and test its capabilities with a view to equipping branch and feeder lines with cars of this kind. The Strang system has already been described in these pages, but it may be useful to recapitulate briefly its principal features. It consists of a gas engine with a direct-connected generator, electric transmission and control, direct electrical connection between the generator and truck motors, and a storage battery. The working of a car is practically the same as an electric trolley car, but, unlike the trolley car, it produces its own current, and is, therefore, independent of trolley wire and power house; in fact, it carries a complete power-house with it. The generator and engine have a capacity sufficient for normal requirements, the generator furnishing all the current necessary; but when starting or ascending a grade the current necessary would demand an engine and generator of much larger capacity were it not for the storage battery, which takes care of the "peak" of the load. The storage battery is charged while the car is coasting down grades, coming to a stop or standing still, the engine running until automatically throttled when the batteries attain the full capacity. The Strang system with its storage battery admits of a comparatively small power plant. The battery is placed underneath the car, and the engine room only needs to be large enough for the engine and the generator. The engine has its six cylinders in line to make it as narrow as possible, and leaves ample room for persons to enter the compartment and inspect the operation of the system.

The "multiple unit control" is used, and enables the car to furnish current to other cars equipped with motors, to which it may be coupled. The car will hold sufficient gasoline to carry it 200 miles, and consumes about six-tenths of a gallon per mile. The cooling system consists of radiators placed on the roof of the car, and circulation is secured by a motor-driven turbine pump. The passenger compartments are heated by pipes connected with the water system. The new car, which has been named "Irene," seats 75 passengers, and will maintain a speed of 55 miles an hour. It can be made the motor-car of a train, being capable of hauling three trailers carrying 75 passengers each. In the event of mishap, its double system of power allows its batteries to carry it for 15 miles.

The car is built of steel, with the exception of the interior, which is composed of vermilion wood, richly carved and inlaid. Behind the engine-room is a compartment furnished with seats placed transversely and upholstered in red leather; the rear compartment has comfortable wicker chairs and the usual fittings of a Pullman car. The observation platform at the rear is enclosed with handsome brass railings. On entering the car one immediately notices that instead of the usual form of dome, the roof is of a complete arched type, prevented from being monotonous to the eye by ventilator sashes set in at regular intervals, and allowing a soft light to come from above through the stained glass with which they are furnished. The ornamentation of the ceiling is Oriental in character, and lends the effect of height by ribbons of gold of irregular length reaching toward the centre.

Interior of Strang Car.



Gas-Electric Railway Motor Car.

The car measures 66 ft. in length over all, and its weight complete is 114,000 lbs. The engine is of the vertical four-cycle type, having six cylinders, 10½ in. by 9 in., and develops 150 H.P. at 425 R.P.M. (continuous rating). The generator is of 85 KW., 250 volt, direct current, shunt wound interpole, and the two motors are each of 100 H.P., 250 volt, series wound interpole

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type. The battery consists of 112 cells of the Plante type of 300 ampere hours' capacity. The cooling and heating system consists of an electrically-driven centrifugal pump, circulating jacket water through radiators on roof or through heating pipes in passenger compartment. The trucks are the standard Brill No. 27—E3 type. The car body was designed by W. B. Strang, president, and L. G. Nilson, chief engineer, of the Strang Gas-Electric Car Company. The engine and accessories were designed by Mr. L. G. Nilson, and the generator and motors were designed and built at the Brill Company's shops, under the personal supervision of Messrs. Strang and Nilson.

BRAKE OPERATING GEAR.

By W. Park.

A great deal of attention has recently been devoted to the subject of brakes for electric cars, and considerable ingenuity has been shown in the methods put forward for stopping a car in cases of emergency. When a car

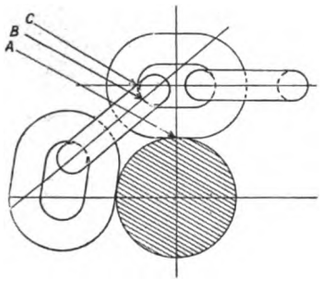

Fig. 1.

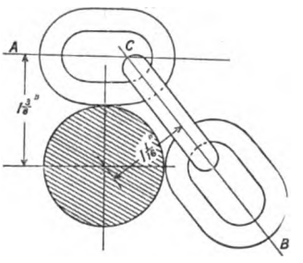

Fig. 2.

gets out of control on a gradient it is usually due to skidding of the wheels through improper application of the brake. It is generally appreciated that the best braking effect is obtained when the wheels are on the point of skidding, but when skidding actually occurs the braking action falls to a very low value. It is therefore apparent that to get the best results with the wheel brake rather delicate handling of the brake lever is necessary, especially when the rails are in a greasy condition. When it is considered that the modern electric car weighs when fully loaded with passengers as much as 16 tons, and is capable of travelling at speeds up to 25 miles per hour, the necessity for installing an efficient and easily regulated brake gear will be readily understood. This is particularly desirable if the motorman is to be relieved from unnecessary exertion; for the frequent stopping of fast and heavy cars by means of the hand brake calls for a great amount of physical effort, and a good deal of this exertion is wasted if the brake gear is inefficient.

In view of these definite requirements it is astonishing to find what a clumsy and inefficient mechanical device is in general use for transmitting the necessary pull from the brake spindle on the platform to the wheel blocks. The gear in use on the horse cars has been adopted practically without modification. Nothing could well be simpler than this contrivance. A rough chain connected to the brake blocks is wound round the end of the spindle by turning the lever. The method has several disadvantages. If the wear of the brake blocks is not taken up, there is a danger of the chain mounting on the preceding coil and so increasing the effective diameter, and consequently seriously limiting the pull obtained.

There is also a loss of energy due to the rubbing of the rough chain when under tension on the coils already in position. Probably the greatest source of loss is the movement of the links on one another when being coiled in place under tension. This movement of the links is shown in Fig. 1. Each link, when coiled on the spindle, moves from "B" to "C," this slipping action resulting in frictional loss of energy. There is also a slipping action of the link when coming into contact with the spindle at "A," which means further loss of efficiency.

Fig. 2 shows another bad feature of the chain and spindle, which is more or less noticeable according to the design of chain, being particularly evident when a long link chain is used. When the pull on the chain is in the direction "CB," the effective radius of the gear is $1\frac{1}{16}$ in. in the example shown, but when the pull is in the direction "CA" the effective radius is $1\frac{3}{8}$ in. The leverage obtained thus varies about 30 per cent., according to the actual position of the chain on the spindle.

The effect of this irregularity in the leverage may be to seriously limit the power of the brake, or to make satisfactory adjustment of the pull very difficult.

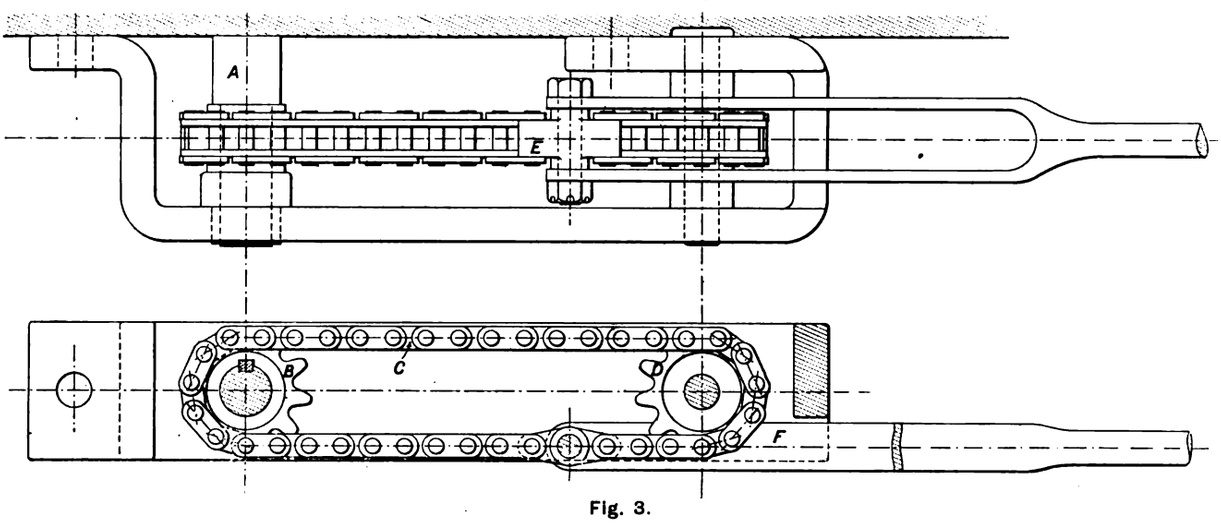

Fig. 3.

As long as tramway engineers are satisfied with this type of platform gear, car builders will continue to supply it, as it is cheap to make and in general use, but, if an efficient mechanical gear is insisted upon, it will be readily forthcoming.

As a suggestion in this direction, the gear shown in Fig. 3 is worthy of attention, and it should be

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possible to instal it at a reasonable cost. The following is a general description of the gear which is fixed under the platform of the car:

The vertical spindle "A" carries the usual hand lever, and the chain sprocket "B" is securely attached to its lower end. A loop of chain "C" gears with this and an idle sprocket "D." A special link "E" is connected to the chain and the forked pull rod "F" is fastened to the link by means of a bolt and nut. A supporting bracket attached to the bottom of the platform keeps the rod in its correct position. The gear shown in Fig. 3 is suitable for use on a bogie car where the floating lever is about the same height as the gear. The same arrangement may be adopted for single truck cars where the truck lever is lower than the operating gear by using a guide pulley fixed under the platform and a short length of flat linked chain connecting to the pull rod.

The use of a gear designed on these lines should considerably improve the efficiency of the hand brake, and may be used for either a wheel or slipper brake.

MAINTENANCE OF TRAMWAY TRACK.

Manganese steel is now generally recognised as being the only suitable material for tramway track work where any large amount of traffic is to be dealt with, and, as is well known by tramway engineers, this material cannot be dealt with by the ordinary cutting tools, *i.e.*, chisels, sates, filcs, etc., owing to the extreme hardness of the material. Owing to the varying amount of traffic which passes over the different tracks of a junction, it is obvious that there will be a difference in the amount of wear which takes place on the different tracks, and consequently when the car is passing from one track to the other there is a drop from the higher to the lower level, causing a pounding action, which will have a hammering effect on the running surface, and this undoubtedly causes far more damage to the track than any amount of ordinary traffic would do. When this arises, it is absolutely necessary, in order to lengthen the life of the junction, to level up these surfaces. The generally recognised method of dealing with this is by grinding off or tapering the higher surface to the lower one.

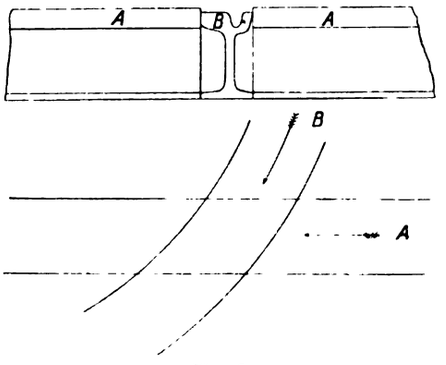

Fig. 1.

In most junctions it is necessary that the amount of repairs should be kept as low as possible, not only from a financial point, but also because of the disturbance of the traffic owing to the renewal of these junctions, and anything that will lengthen the life of same is worthy of the most serious consideration on the part of tramway engineers. If this pounding action is minimised by keeping the running surfaces fairly level, the life of the junction should be considerably lengthened, and all Corporations and tramway companies will be well advised to obtain the most suitable tools for accomplishing this purpose.

In addition to the damage done to the track through uneven surfaces, they also entail considerably more wear and tear on the car trucks, bringing about broken

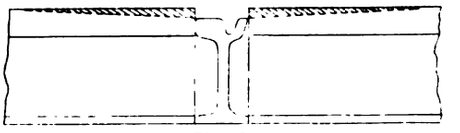

Fig. 2.

Fig. 3.

springs, loose joints, etc. The same thing, of course, applies to the ordinary rail joints, which, all engineers recognise, are subject to very uneven wear, and it is necessary for these joints to be levelled up from time to time.

Fig. 1 gives an idea of what takes place in a junction with a varying amount of traffic over converging tracks. Fig. 2 shows how this should be levelled off to do away with the pounding action which takes place when the car wheels drop from the higher to the lower level. Fig. 3 shows the general method of levelling up rail joints by up-setting, or raising the end of the worn rail, which is then ground down to bring the two surfaces level.

In order more fully to meet the requirements of such work, Messrs. George Robson, of Eclipse Engineering Works, Sheffield, have recently introduced the machine illustrated in Figs. 4 and 5. This machine, it will be seen, is self-contained, being driven direct through gearing by the electric motor mounted in the centre of the carriage. The emery wheel is carried in the crosshead of a long sliding frame, and is driven through bevel gears by the shaft to be seen between the two bars forming the sliding frame above referred to. A long keyway is cut in the shaft to permit of driving from the motor with the shaft extended to any desired amount within a range of 3 ft. Within this limit the machine may be worked without shifting the carriage. The two outer shafts or frame bars are carried between rollers, which act as guides. The whole arrangement, motor and sliding frame, is carried in a cradle, and pivoted so that the emery wheel may be raised or lowered while working. It will be seen also from the illustration that the machine is mounted on a turntable carriage, and it will swing completely round on its base, so that work may be done in almost any position. The question of balancing has been carefully considered, in order to render it possible for any one unskilled man to work it. The machine is very steady, and free from vibration in working; and, though light, it is amply strong enough for its work. One of these machines has recently completed a nine months' trial, during which period no hitch of any kind occurred in the working.

In addition to the uses which this machine can be put to on the track, it is a very handy tool for use in the car repair shops, and can easily be adapted to take the place of, or act as, a grinding machine for truing up car wheels without removing them from the truck; the car wheels, being raised slightly clear of the rail, are then driven by their own motor, and the emery wheel of the track grinder is brought up to the surface of the tyres and the whole ground up in position, all irregularities being removed. By attaching a rest to the cross-head of the machine it can also be used as a

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fixed emery grinder for grinding up castings, forgings, tools, etc., either on the road or in the depot, thereby saving a large amount of labour in chipping or filing.

For general shop use, where it is not desirable for the machine to be moved, Messrs. Geo. Robson and Company have designed a modification of this machine,

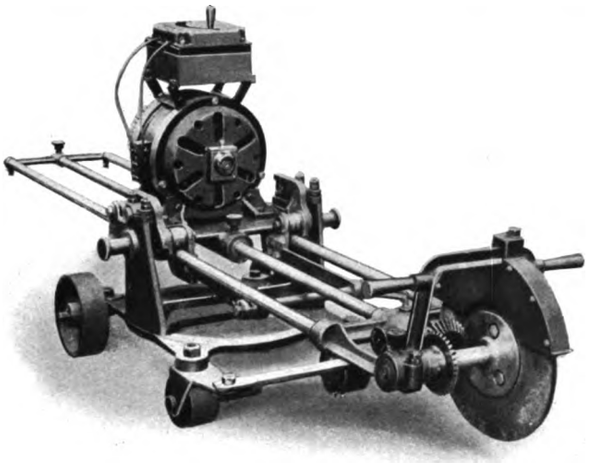

Fig. 4.—The Eclipse Portable Rail Grinder.

which may be hung from any beam or girder, as shown by Fig. 6. This machine is entirely self-contained, being driven on exactly similar lines to the track grinder mentioned.

All machines of this type have hitherto been driven by means of endless ropes, or belts, but, owing to the high velocity at which these work, there is considerable wear on them, entailing expensive renewals. In this machine, owing to the emery wheel being positive-driven, there is an entire absence of slip between the motor and the emery wheel, and the firm claim that

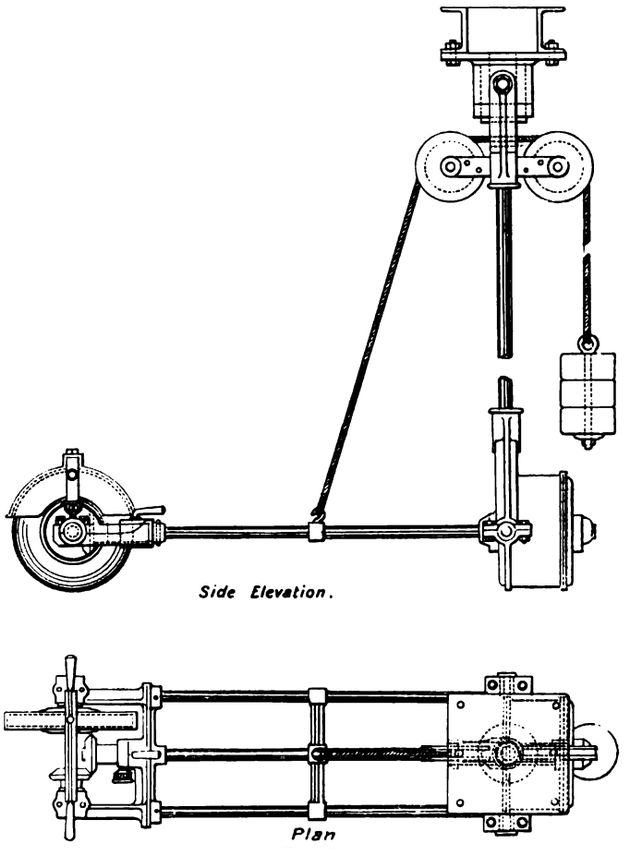

Fig. 6.

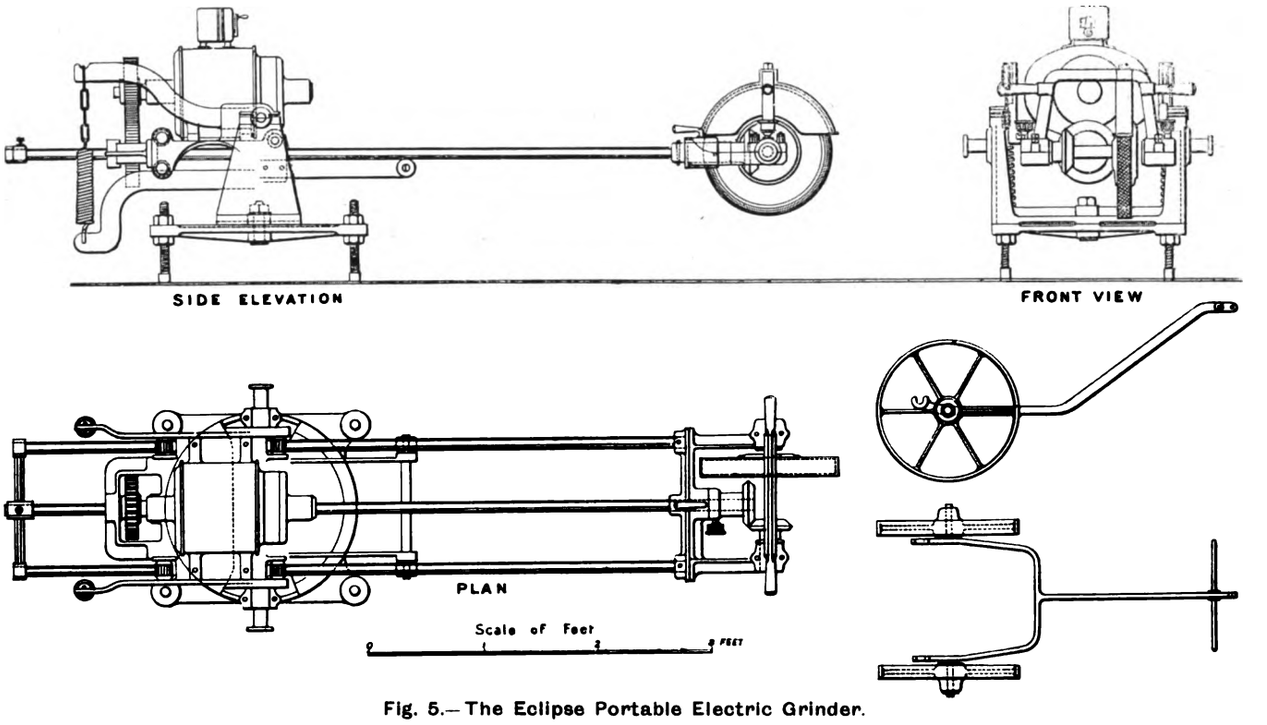

Fig. 5.—The Eclipse Portable Electric Grinder.

they can get considerably more work from this machine by the same expenditure of power, than any other machine on the market, and the cost for repairs is infinitesimal. The emery wheel may be swung in a complete circle round the centre of the machine, and work done in any position and at any angle within this radius. The gearing has been carefully designed, and all wheels are machine cut from solid blanks of a carefully selected quality of steel, specially case-hardened, and it has been found after an extended trial that the wear on these wheels is not apparent. Fig. 5 shows the portable grinder fitted on feet instead of wheels, with transport cart.

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THE

Tramway AND Railway World

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We shall be pleased to receive at all times articles, papers, notes, and correspondence on subjects of interest to those concerned in the financial administration, construction, or management of tramway and light railway undertakings. Particulars as to the issue of specifications, the progress and completion of contracts for new work, and suggestions for improvements in all branches of tramway enterprise will receive special attention.

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LONDON, APRIL 2, 1908.

The Shackles on the Industry.

Not for several years has there been such a glaring example of the iniquity of the Parliamentary standing orders which give local authorities a power of veto against tramway schemes as that which has been afforded at Westminster within the past month. The number of bills promoted in the present session of Parliament for the construction of tramways is unusually small, and the schemes brought forward are not very extensive. This applies alike to bills promoted by local authorities and those brought forward by companies. The reasons are well known. Monetary stringency has acted alike on both classes of promoters. Local authorities, too, are now pretty well supplied with lines within their areas, and have been chary of going beyond. Companies have been discouraged by the hostility of local authorities. An exception to the general backwardness was a gallant band of private promoters who sought powers to construct various tramway lines in the country round London. Such lines included the great combined scheme for motor roads and tramways from London to Windsor, a system of lines linking together towns and villages to the south of Croydon, tramways from Hammersmith to Barnes and Richmond, and a short tramway across Kew Bridge to connect the London United lines north and south of the Thames. With the exception of the last-named scheme, for which a dispensation has been granted, all these are gone, utterly swept out of existence by the fiat of standing orders. It has been found impossible to get the consent of the local authorities, and in the case of the motor roads scheme other standing orders have also been infringed. Even the London County Council's Tramways Bill has been docked of some of its proposals. We are not here discussing whether these were good or bad bills. That point has not arisen, and it could not arise until the bills went before Parliamentary Committees to be considered on their merits. The grievance is that no opportunity is allowed to the promotors to prove their case. Various attempts have been made to secure a revision of the standing orders, but the efforts made have never been heartily supported, and they have so far proved unsuccessful. It is surely more than time for an organised effort to be made to alter standing orders which even in the days of horse tramways were restrictive, and at the present time are at once irritating, absurd, and a shackle on industry. We believe that no other kind of undertaking which requires to be authorised by private bill is subject to this veto by local authorities. As some of the large municipalities have had a taste of the veto themselves, it is perhaps not too much to hope that they will join forces with private promoters to get the embargo removed. All that promoters want is a fair field and no favour. Parliamentary Committees can be trusted to consider schemes impartially, and not to pass them if it can be shown that they are not needed or would be prejudicial to any district. If reform is much longer delayed, tramway promotion by individuals or companies, apart from exceptional cases, threatens to become a thing of the past.

Tilbury Railway Electrification.

Another electric railway extension has been completed in London by the opening on April 1 of the Tilbury Company's line between East Ham and Barking, a distance of 1¾ miles. The line is worked by the District Railway, whose train

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services now extend from Barking in the east to Wimbledon in the west. The District Railway tracks terminate at Whitechapel, and the service eastward is continued for two miles on the Whitechapel and Bow Railway to Campbell Road Junction. From the latter point to East Ham the District trains run for about three miles over the lines of the Tilbury Company. The decision to extend electrical traction to Barking was made by the directors of the London, Tilbury, and Southend Railway in order to cope with the greatly increased passenger traffic from the latter station. The Tilbury Company occupies a somewhat anomalous position. It has several large and important stations in the eastern suburbs, from which there is a heavy traffic into the City. At Barking Station, for instance, there are eight platforms, and at Plaistow there are six. Yet the company has no London station of its own, and the only accommodation provided for its trains in the metropolis is one platform and bay of the Great Eastern Company's station at Fenchurch Street. In these circumstances the company has found it convenient to turn a considerable proportion of its passenger traffic on to the other lines running into London, and its alliance with the District Railway has, in particular, served a useful and profitable end. This is by no means the first instance of a steam railway finding it convenient to deflect its traffic to an electric line on reaching a congested area, but it is the first case, we believe, in which the steam company has voluntarily equipped its own lines for the purpose of feeding another system. In view of the general attitude of the railways towards electrification, it is instructive to find that this enterprising company, which ranks among the best dividend earners in Great Britain, has thought it well to provide the capital for an electrical venture.

The Franco-British Exhibition.

The opening day of the Franco-British Exhibition is approaching with giant strides, and everybody connected with the enterprise is working at white heat. If only for the reason that a whole army of men have directly and indirectly found employment on the grounds, on the buildings, and on the exhibits, who but for the Exhibition would have helped to swell the ranks of the unemployed during a most critical time, the efforts of the promotors deserve to be crowned with success. The Engineering Committees are now busy making their final arrangements, and the names of the chairmen alone are a guarantee that everything possible has been and will be done. Sir William H. White is the general chairman of these groups—the individual chairmen being: Constructional, Sir Alexander Binnie, who, amongst other things, is collecting a fine series of models; Mechanical, Mr. T. Hurry Riches, who will secure a representative display of machine tools; Electrical, Dr. Glazebrook, whose efforts must to some extent be handicapped by the Manchester exhibition, but who, nevertheless, is very sanguine of success; Metallurgical, Sir Charles Maclaren, Bart, M.P., who has collected specimens of some of the heaviest work ever turned out; Transportation, Mr. H. Cosmo Bonsor, M.P., whose name is so well known to railway men; and, finally, Surface Transport, Sir Clifton Robinson, who has on his committee representative men in all branches of his group in which, also, the Hon. Arthur Stanley, M.P., must of necessity take a great interest. Here, again, the rules of the Motor Union will prevent many makers of British motor vehicles from being represented; it is hoped, however, that a show of great interest to tramway owners will make up for this deficiency. All the railways and tramways with stations, old and new, near or connected with the Exhibition, are looking forward to increased traffic receipts, and are making extensive preparations to handle it— this welcome addition to their takings is only one amongst the many benefits that will result from Mr. Imre Kiralfy's magnificent conception. A proposal which is likely to be carried out is that the London County Council tramways in Wood Lane should actually enter the Exhibition grounds by a loop. Entrances to the grounds will be provided from the Uxbridge Road station of the West London Extension Railway on the south, and from the St. Quintin's Park Station on the north, while the Great Western are laying a siding from between these two stations right into and round the northern boundary of the grounds, connected with sidings and turntables, serving every part of the enormous Machinery Hall. Another entrance will be from a new station on the extension of the Central London

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Railway, while from a new station between Shepherd's Bush and Latimer Road the Metropolitan and Great Western Railways will deliver passengers at the southern entrance. Of tram lines and omnibus routes, both horse and motor, there are a great many from all parts of London, and the daily transportation of three-quarters of a million visitors will be easily effected by these means, exclusive of those arriving on foot or in other vehicles.

Financial Position of London's Tramways.

The independent commercial report upon the accounts of the tramway undertakings of the London County Council has caused much discussion, which has, unfortunately, been largely biased by party views. The principal item around which contention has chiefly taken place related to the loss entailed by conversion to electric traction. The facts are, however, quite simple. The Council purchased certain tramways which were far from worn out, and had the operation of these tramways been continued as horse tramways there is no reason to doubt that the net receipts that might have been realised would have amounted to a moderate return upon the purchase price. The London County councillors recognised quite rightly, however, that the public would not tolerate the continuance of the antiquated system of horse traction, and without much delay the old track was torn up and the conduit system was installed. In so doing the Council were undoubtedly actuated by the best motives. In the conditions under which they were compelled to act it is open to question whether any better course could have been adopted; but the loss incurred so far, after allowing for the value of the old materials, amounts to rather over a million pounds, which the accountants responsible for the commercial audit consider should be debited to revenue. The party formerly in control of the Council denounce this as ridiculous and contrary to commercial practice anywhere. This is distinctly rash when the position of the auditors is considered. Mr. W. B. Peat and Mr. F. W. Pixley are well-known names, the former now does, and the latter has recently, occupied the position of president of the Institute of Chartered Accountants. Cases of scrapping old plant before its earning capacity is exhausted, in order to make room for new plant of greater earning power are more frequent in the United States of America than in this country. The process is there usually referred to as betterment, and the amount of the unrealized value of the scrapped plant is always made a charge against revenue. We in this country are not always so particular. The Central London Railway recently afforded an example, when the directors placed to capital the loss incurred in scrapping their original locomotives. There can be no doubt that the practice favoured in America is the best, to burden the capital account of a company with items of this kind quickly leads to over-capitalization, so that the company is not in a position to compete on even terms with new undertakings. The London County Council tramways are in a great measure free from danger of competition, but the first instruction to the auditors in this case was to deal with the position of the undertakings from a commercial point of view, and this was in effect an instruction to treat the undertaking as liable to the competition of rival construction. There is, consequently, little cause to complain of the verdict in this respect. Nor can any fault be found with the suggestion that the Council should adhere to its own resolution in reference to provision for depreciation. The Council have always known that in the opinion of their responsible advisers no less a proportion than one penny per car mile run should be put aside to meet future contingencies before a balance was carried to net revenue, and it was definitely stated, on more than one occasion, that the Council intended to carry out that policy. When it was necessary either to admit a deficit or to sacrifice its own rules, the dominant party in the Council appear never to have had the courage to adopt the better alternative. Consequently the amount now properly chargeable to depreciation, but not so charged, has grown between April, 1903, and March 31, 1907, to £77,636. During the same period considerable sums have been paid in relief of rates, which it seems clear have been improperly allocated to that purpose. The question what proportion of expenditure on street improvements made in connection with tramway construction should be charged to the latter, is one of some difficulty; but the auditors show quite conclusively, we think, that nothing like an

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adequate sum has been contributed by the tramways. On the whole, the conclusion cannot be resisted that the ratepayers have not been fairly treated. While receiving some relief from the alleged profits from the tramway department they have, in fact, been saddled with additional rates rendered necessary by street improvements required by the tramways, while the depreciation of their property in the tramways has not been adequately provided for. On the other hand the users of the tramways have benefited by fares, the cheapness of which could only be justified if there were actual profits from the working of the tramways. As it is, the tramways are at present, if the auditors' report be accepted, actually working at a loss. In the circumstances the only course which the Council can honestly take is to study the present system of fares carefully, with a view to such increases as will produce the necessary revenue, while inflicting the least possible inconvenience on the users of the tramways. If this is not done, the complaint that other undertakings for public transport in London are being subjected to rate-aided competition cannot be refuted.

CORRESPONDENCE.

Depreciation.

To the Editor of the Tramway and Railway World.

Sir,—Your notes in the issue of February 6 undoubtedly bring forward again a very important point which deserves a good deal more attention than is usually given. From somewhat long experience in the matter, I may say that depreciation is as a rule treated more or less by accountants only, when it ought to have the close attention of technical valuers as well, who make such subjects a speciality.

It is folly to say, as you put it, in an off-hand manner that depreciation should be allowed for at this rate or that rate, with apparently no reason for fixing the figures.

Real depreciation should be treated under two heads, one the "Actuarial" and the other the "Technical." The first one is merely a matter of figures, and where different parts of a concern are governed by circumstances which limit their life to a known amount, nothing is easier than to provide for the amortisation by arranging the finances accordingly. The same applies to the repayment of a loan—this can be treated in the same way.

A very different case is that of the machinery, whether moving or stationary. No power on earth at the present time, especially in electrical matters, can say that this portion has such a life, and that, another life to run. This is borne out by the fact that in many cases plant has been thrown out and superseded, which in itself was good, and had, as a machine, *per se* many years to run.

This points to the fact that constant and special supervision should be exercised by having periodical inspections by independent technical experts, who would fix upon figures which would represent the then value of the items coming under the heading of plant, etc. This in itself would be independently fixed apart from the upkeep. There is, however, the factor to be considered that no two stations can be governed by the same rules as to upkeep, and, here again, this circumstance must be taken into consideration alongside the fact above mentioned.

If the plant were periodically inspected and valued as suggested, the expense would be trifling as compared with the advantages obtained, and private companies and public bodies would have the satisfaction of knowing that an expert's opinion had been obtained, and thus their interests would be safeguarded, and the accounts would give a much more representative value than if the depreciation were merely written off by "standard rates," which could not under any condition be applied to all circumstances and concerns alike.

The periodical inspection and report by expert valuers is daily becoming more the custom where private firms are concerned. Directors of Limited Companies, being looked upon more and more as trustees for money invested in the concern they preside over, are in many cases safeguarding themselves by such means; how much more should those who have the direction of Tramway and Electrical undertakings, consider the interests which they represent! I think I have shown that the means suggested by your leader, of having a standard system dealing with depreciation, could not be carried out in a manner which would do justice to the many concerns whose interest you have at heart.

You are quite right in mentioning that a speaker at a discussion when dealing with depreciation seems often hazy in what he means, and the community at large must thank you for bringing the point forward in such a manner that perhaps we shall be able to see light come into this all-important matter when treated under the two heads which I mentioned at the beginning of this letter, the more important being the "Technical" depreciation which is always the "x" in the problem peculiar to the installation being treated, and the solution of which is "Treat it on its own, in its own building, and on its own merits." A so-called standard of technical depreciation is a will-of-the-wisp which often leads accountants astray.

Faithfully yours,

Ajax.

South Shields Corporation and "Fair Wages."

To the Editor of The Tramway and Railway World.

Sir,—I see that the County Borough of South Shields are advertising for a "general manager" of their electric tramways, and offer the munificent salary of £250 per annum! Is it not time that practical men engaged in this profession began to organise on trade union lines? What have the existing associations to say for themselves that such a state of things as this advertisement indicates is possible? No doubt this enlightened Corporation insist upon the usual fair wages clause being inserted in their contracts, but what class of commercial and engineering experience can they expect to purchase at such a rate for a business in operation for 16 hours a day throughout the year. May they get what they deserve is the ardent hope of

Yours obediently,

A Midland Manager.

Mr. C. C. Butler, assistant in the Willesden electricity department, has been promoted from the second to the first-class division, at a salary of £160, rising to £200.

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THE EDUCATION OF GRANNY.

We live in an age of Grandmotherly legislation, and Granny's special pet is the British workman. Before she took charge of him he was a fine manly little fellow, though a trifle unruly and uproarious at times, but she is doing her best to spoil him and to convert him into a coward and a sneak. For all her affection, she is more than a little afraid of him; she knows he is often disobedient and troublesome, but she dare not punish him, so when he gets into mischief she punishes somebody else. If, in spite of warning, he plays with fire and burns his fingers, it is the housemaid who lighted the fire that is spanked, notwithstanding that if she did not light it she would lose her place. Does he make himself ill with eating apples? Upset the apple cart and drive the old apple woman into the workhouse; she has no business to put temptation in the poor darling's way. If he sulks and refuses to join his brothers in play, he is encouraged to close the playground to them, and peacefully to persuade them (with brickbats and the buckle end of a belt) to loaf with him in the streets till the rules of the game be altered to his liking. Whatever he may do is right, in her eyes, because he does it, and if the consequences be unfortunate it is the fault of someone else, who must be made to pay for it somehow.

The Factory Act of 1901 was one outcome of this grandmotherly notion, which is not confined to any particular political party. By it the Home Office was empowered to declare any trade dangerous, and to frame regulations under which it might be carried on. The sole protection granted to those whose business was thus regulated was that in case objections were taken to the regulations a public inquiry should be held before they were passed. It seems to have been assumed that the Home Office would be guided by the report of its Commissioner, though it clearly had the option of putting it into the waste paper basket and proceeding as though no inquiry had been held. So far as the matter has now gone, the former assumption is clearly justified in the case of the inquiry into the "draft regulations for the generation, transformation, distribution, and use of electrical energy," which was, in 1904, declared to be a dangerous trade under the Act. True, the initial attitude of the Home Office was anything but conciliatory. Quite early in the proceedings it declared, by the mouth of Mr. J. H. Gray, that if the limits of voltage, below which exemption from the rules was granted, were raised, it would not be with the consent of the Home Office. That department did not settle what pressures were permissible, it only laid down the conditions under which they might be used. This declaration naturally provoked the question, put by Lord Robert Cecil—"Why, in that case, go through the solemn farce of an inquiry at all?" If the Home Office had made up its mind, and meant to disregard the evidence, why all this trouble and expense? Thereat Granny first began to climb down. While Mr. Gray could not bind the Secretary of State, he was sure he would give due weight to the Commissioner's report. But no considerations of expense would influence the Home Office where human life was concerned—a very noble sentiment—and no appeal would be allowed from the Home Office and its technical advisers. Subject to those conditions the Home Office would willingly hear what the objectors had to say and try to meet their views. One concession it was ready to make unasked. It would not require an occupier to be subject to criminal prosecution for defects in apparatus on his premises but not under his control, such as the fuses on the supply side of his terminals, with which he had no right to meddle. Also an endeavour would be made to relieve him of any obligation to obey two, possibly contradictory, sets of rules at the same time. Dual control, by the Home Office and the Board of Trade, was to be abolished. It appeared subsequently that this involved taking away all control from the Board of Trade, save as regarded the street mains.

At a very early stage of the enquiry it became clear that the objections were neither small nor on mere points of detail, but that the regulations, especially if made retrospective and rigidly enforced, would impose a crushing burden on the industry. Even the Home Office recognised that, but its plea was that its inspector, Mr. Ram, was a most benevolent despot; the last man to order a station to be rebuilt because it did not comply with his regulations. He consulted with the engineer, brought him under one of the exceptions, or got him to do something cheap to his satisfaction. "They never executes nobody, you know," as the Gryphon said to Alice. It is necessary to go to Wonderland for parallels to this amazing enquiry. But the industry is disinclined to be at the mercy of any tyrant, however benevolent. He might change his mind, or his successor might be less compliant. Moreover, engineers had something else to do than perpetually to appeal to Mr. Ram against the absurdities of his inspectors. The end of it would be that, wherever possible, the regulations would be complied with to escape worry, though the practice enjoined were neither the best nor the safest. As the enquiry proceeded the Home Office case was more and more broken down. The rules first considered in any detail were 17 and 12, the one imposing *inter alia* certain dimensions for switchboard passages, the other ordering the general adoption of a no-volt release for all but very small motors. With regard to both these, the evidence of Mr. Merz, backed by that of other engineers of repute, was conclusive. The Home Office ideal of a switchboard was already obsolete; to comply with its regulations would mean enormous expense and diminished security. The no-volt release for three-phase motors had been invented but was not used, and was quite unnecessary. Mr. Merz supposed dimensions were prescribed because the ordinary inspector could understand them. It was also contended that the Home Office had really no power to be as benevolent as it claimed to be in practice. It might grant exemptions, but Granny was not the only old woman in the country, and any busybody might institute a prosecution under the Act if the letter of the regulation were not complied with.

The evidence of the Home Office experts rather strengthened the case against it than otherwise, but help came from an unexpected quarter. Mr. Campbell Swinton offered himself as a witness, and declared against any regulation whatever. Leave things dangerous, and tell your workmen not to touch them. Safeguards are illusory; there may be a crack in an insulating cover, and reliance on it may be the death of a man. Regulate the man, not the machine, if you wish to be safe. This, of course, was rank treason to the first principles of Grannydom, and, like most overstatements, injured the cause it was meant to help. Some regulation is obviously necessary, though it is best made by those on the spot, familiar with the special circumstances. It is not enough to tell people not to touch live metal; provision must be made for rendering it dead when it is necessary that some one should work on it. But it is better that Mr. Lackie should make that provision in Glasgow, Mr. Talbot in Nottingham, and so forth, than that Mr. Ram should make it for the whole kingdom.

So things went on, and the humiliation of Granny became painful to witness. No one doubted her good

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intentions, her belief that it was her duty to safeguard her precious one, and her real anxiety to give as little trouble as possible in so doing. But as her education proceeded it evidently dawned on her that she was meddling in a matter she did not quite understand, and between her reluctance to confess so much, and her fear of being shown up as an obstinate old fool, she stood trembling, afraid to climb either up or down. At last a happy suggestion was made. Why not settle the thing in private? Certain representatives of the principal objectors might meet the Home Office representatives and talk things over in a friendly way. The idea was acted upon and the result is before us. A new set of regulations has been issued, from which nearly everything objectionable is eliminated. It bristles with saving clauses, such as "so far as is reasonably practicable," and "where (or when) necessary." The dimensions laid down in "sweet 17" are partly retained, but the main objection to them is removed by making the rule applicable only to switchboards and passage ways *constructed after January 1, 1909;* and the alternative of divisions, screens, and other suitable means is offered. Regulation 30, respecting the posting of instructions for the treatment of shock, is left for the Commissioner to deal with, and the structure of sub-stations was left for further argument (finally the Home Office agreed as to the reasonableness of making some concession to the special difficulties in London, where the size of underground sub-stations is restricted, against the desire of the undertakers, by the action of local authorities). But in the main, the objections raised to the original draft have been met; Granny has climbed down completely and her education is finished. One trifling defect remains that could easily be remedied, and is due, in part, to the way in which the rules have been amended. "That's not a regular rule; you invented it just now," said Alice to the King of Hearts. There was a good deal of this sort of thing at Caxton Hall last month, and, in consequence, some of the rules are disfigured by inelegancies of diction (such as split infinitives) and redundances of language. It does not matter much, for the regulations are intended to be observed, not to be read: but, after all, the Home Secretary is the King's Minister, and, it is not fitting that he should make fritters of the King's English.

When the inquiry was resumed on Tuesday, March 24, a few verbal corrections were submitted, one of which, strange to say, was the removal of a split infinitive. The opposition, while allowing that the rules were now, as Mr. Faraday Procter pithily put it, "harmless though useless," still asked for further concessions, of which the chief were—(1.) That no prosecution should be taken under the rules without the *fiat* of the Home Office—This was conceded in principle, subject to the opinion of the law officers as to the means of securing it. (2.) Exemption in all cases where the pressure did not exceed 250 volts; and (3.) Arbitration by an expert in case of dispute. As regards (2.) it was urged that there had never been a fatal accident, at low pressure, save that in the Fulham baths; and it may be noted that the regulations would not have prevented that, since public baths are not a factory, nor is a bather an employee. Mr. Gray replied by asking whether an industry must needs take its toll of lives before any precautions were taken to make it safe; and he put Mr. Patchell in the box to give evidence as to experiments made at low voltage, with conductors half-an-inch thick firmly grasped by the hands; part of which evidence was that at 65 volts alternating "I could not grasp them as hard as I could." The experiments were clearly made *ad hoc*, for no one knows better than Mr. Patchell that these are not the conditions under which workmen receive shocks in actual practice. It was also pointed out how unfair to alternate current supply would be a rule which would bring all A.C. work under the regulations, while exempting many D.C. systems, and that the small user, if he were worried by being brought under this Act because he employed two or three girls in hat trimming at the back of his shop, would give up electric light and go back to gas. But Mr. Gray was obdurate. A man might touch live metal while standing on a high platform, and be startled so as to get a fatal fall. Or a fuse might blow in his face. It was quite impossible to get Mr. Gray to understand that the blowing of a fuse was a question of current, not of voltage at all, and that the higher the voltage in general, the less the current, and, therefore, the less that danger.

With respect to arbitration the objectors naturally prefer that technical questions should be argued before a technical judge, not before a bench of magistrates. Granny no less naturally prefers the more ignorant tribunal. She has cut a pretty figure before one technical Commissioner, and does not want to repeat the experience. Mr. Gray's argument was that of the Wonderland executioner when called on to behead the bodiless Cheshire cat—"He had never had to do such a thing before, and he wasn't going to begin at *his* time of life." The present inquiry had been substituted by the legislature for arbitration, and the Home Office had no arbitration under the Factories Act. The coal mines regulations provided for it, but that was a very small industry, and the less said about it the better. Mr. Swinburne's report will be awaited with much interest, as also the Secretary of State's action thereon. The inquiry has made it abundantly clear that it was an error of judgment to declare the electrical industry a dangerous trade at all, while the much more dangerous gas goes unregulated, and that the Home Office is quite incompetent to regulate it. It is the Home Office that is dangerous. But the sting has been taken out of the regulations, and if adequate protection can be secured against the busybody and the untechnical bench, Granny may be allowed to retain the semblance of authority without serious harm to anyone.

GARCKE'S MANUAL.

The twelfth volume of the Manual of Electrical Undertakings and Directory of Officials, compiled under the direction of Mr. Emile Garcke, has now appeared. There are the usual statistical notes on the industry, and it is not surprising to find that there was less progress during last year than during the year before, in spite of the greater activity of trade generally. The reviews of the several branches of the industry—electric light, power, traction, telegraph, telephone manufacture, and miscellaneous—are conducted with usual regard for perspicuity and condensation with which the recurring issues of the manual have long accustomed us. As frequent users we can also vouch for the substantial accuracy of the constitution—accounts, comparative tables, and analysis of working of the several undertakings, given in alphabetical order—but the form in which the accounts of the various undertakings are arranged present a curious anomaly. The expenditure and income on revenue account are invariably given with the position of the columns reversed, the traffic receipts being placed on the left hand, or debtor, side, and the expenditure on the right, as if the account were one of receipts and payments.

The practice, which has been followed consistently since the manual was first started, is very confusing. Errors are apt to arise when on consulting a book of reference expenses are found where receipts ought to be, and seeing that the arrangement is opposed to the whole theory and practice of accounting, it is to be hoped that in future issues the general usefulness of the manual will suffer no longer as the result of this solecism.

Surplus Land at Trafford Park.—We learn that one of the largest firms on this estate is offering at cost price about 50 acres of its freehold not required for extensions. This firm was one of the original buyers, so that, considering the great improvements since made at Trafford Park for facilitating all sorts of industrial operations, there should be a chance of picking up a good bargain in land at a time when our Continental friends, urged by the new Patent and Designs Act, are now actively bidding for lots everywhere.

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TANGENTIAL METHOD OF TROLLEY WIRE SUSPENSION, AS APPLIED ON DERBY TRAMWAYS.

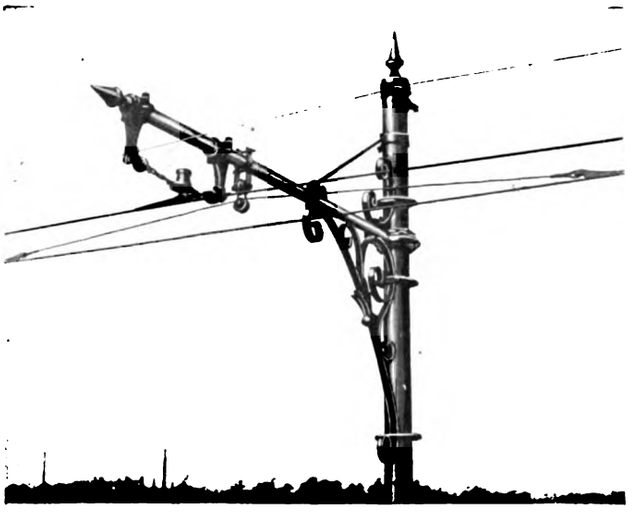
CONTRIBUTED.

The Derby Corporation tramway system has lately been extended for about 1½ route miles along the Uttoxeter Road with trolley wire supported on the bracket arm system, and for about 1¼ miles in the Ashbourne Road on the span wire system. The system with these extensions now consists of 20 track miles, with a route mileage of 14. Mr. T. P. Wilmshurst, borough electrical and tramways engineer, is responsible for the electrical equipment of these extensions, and he is to be complimented on being one of the first to act on the fact that the present-day methods of suspending trolley wires have many defects, and that the tangential suspension system would offer many advantages.

In January, 1907, he decided to adopt this system for the whole of these extensions. Messrs. R. W. Blackwell and Company obtained the contract for the overhead equipment excepting the actual suspensions, these being erected by the tramway department staff under the supervision of Mr. Wilmshurst and Mr. F. Harding, general manager of the tramways.

The tangential suspension system of supporting electric overhead lines is the invention of Mr. P. J. Pringle, borough electrical engineer and tramways manager to the Burton-on-Trent Corporation, and this system has been in operation on his tramways for over 18 months.

The Burton-on-Trent tramways are erected with 000 B. and S. circular trolley wire with soldered ears. They have now been running for 4½ years, and during that time no fractures of trolley wire have occurred. All parts of the line where the rigidity is greatest

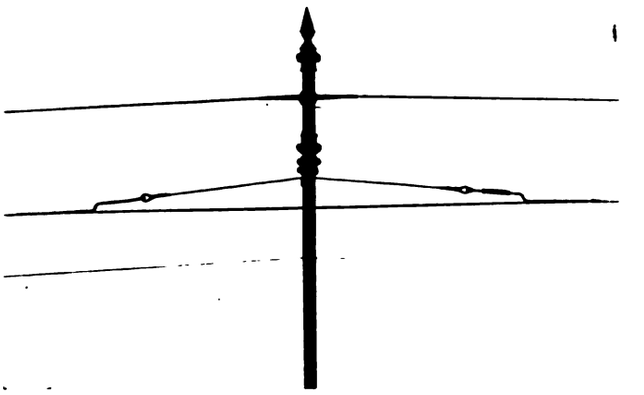


Comparison of Bow String and Tangential Suspension on Same Pole.

have been changed over as quickly as possible to the tangential method of suspension, and whenever an ear renewal is required the old suspension is done away with and the tangential suspension installed.

After three or four years, trouble with falling trolley wires frequently commences in many towns, and on some systems a little older than this the trouble has become very serious. In several of our large towns, Manchester and Dublin for instance—and the same occurs in Berlin—fractures of the trolley wire have become so frequent that it has been necessary to put a supporting anchor wire on either side of nearly every ear on the undertaking, so that in the event of a fracture the anchor wire will hold the trolley wire up and prevent it doing damage in the street. Such a method, of course, acts as a safeguard, but at the same time it cannot prevent the trouble or moderate the liability of fractures occurring later on.

With circular wire, however carefully finished off the ears may be, there must be a blow between the ear and



Tangential Suspension on Very Slight Pull-Off.

the trolley wheel, together with arcing at the trailing ends of the ears. On many undertakings the soldered ear has been replaced by the clinched ear, but in this type it is necessary to make the sides of the ear a little stouter than with the soldered ear, so the effects mentioned above are slightly increased. Both these types of ears, as they are in the path of current collection by the trolley wheel, must suffer from wear and require renewal more or less frequently according to the service of cars and the extent of up-hill gradient.

The introduction of grooved and figure 8 wire has been an attempt to get over these difficulties by giving a more or less even through run to the trolley wheel, but unless great care is taken to keep the trolley wheel turned up from time to time during its life, and to see that the groove is not worn too deep, these disadvantages remain, though to a reduced extent. Both grooved and figure 8 trolley wire are generally recognised as being more difficult to erect, and an effect which in some cases is now becoming apparent is the greater rapidity of wear of the trolley wheels and increased wear on the trolley wire towards the centre of the spans. Mr. Pringle is of the opinion that this is due to the difficulty of keeping the grooves of the wire after it has left the ears on the horizontal plane, so the frictional area of contact is reduced, and what is perhaps much more important, the density of current at the collecting point is increased considerably.

There are cases where trolley wheels have not half the life on grooved wire which they have on circular wire; this point, therefore, is a matter for careful consideration, as it is obvious that there cannot be increased trolley wheel wear without a corresponding increase in the wear on the wire.

The mechanical ears used in grooved and figure 8 wire are very rigid in the vertical plane, and this rigidity continues to the ends of the ears, and localises the alternating stresses due to vibration of the trolley wire to a greater extent than with the soldered or clinched ear, which has a certain amount of flexibility in the vertical plane throughout its length.

The composition insulator used in tramway work becomes another source of trouble after a number of years. The actions at work have been very fully dealt

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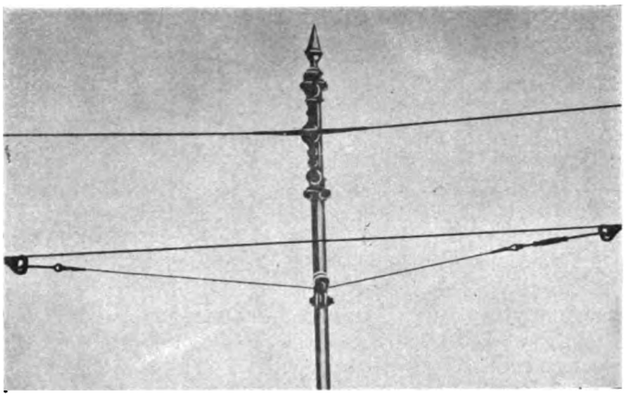
with by Messrs. R. N. Tweedy and H. Dudgeon in their valuable paper on overhead equipment.

For some time certain new undertakings have used brownware or porcelain for the secondary insulation, but a year and a half ago Mr. Pringle realised that it would be advantageous to utilise this material for both primary as well as secondary insulation, and as far as we are aware he is the first to adopt throughout this form of insulation for tramway work. Its advantages are very obvious, it being practically indestructible, and very cheap to renew should this be necessary.

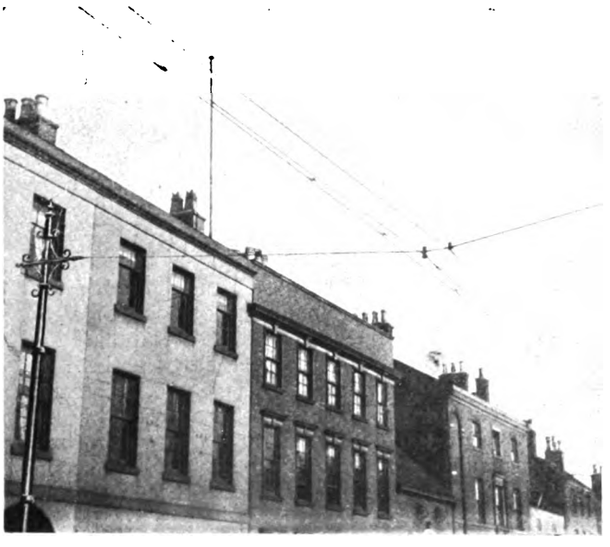
The actions bringing about deterioration and fractures of trolley wire have been very fully dealt with by Mr. Sheardown in his paper before the Institute of Electrical Engineers at Dublin, and his opinions fully confirm those held by Mr. Pringle. The supporting of any overhead wire at a central point means that any vibration transmitted to the wire on either side of this is mainly damped out at this point, and in this damping-out action the wire adjoining the supporting portion of this central point must be subject to alternating stresses, which in time bring about a change in the molecular structure of the wire, or, in other words, produce crystallization, which may be sufficient to lead eventually to its fracture.

The main principle of Mr. Pringle's method is the supporting of the trolley wires and the fittings by means of suspension wires tangential to the natural curve of

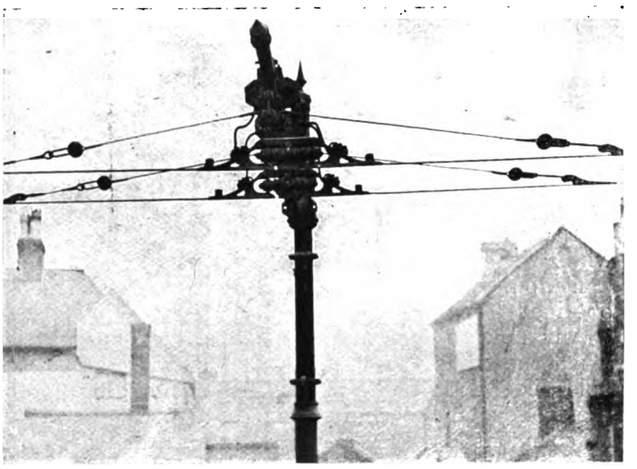


Tangential Suspension to a Medium Pull-Off.

the trolley wire. Assuming that the trolley wire is 000 gauge, then at the point of support there will be a downward pressure of some 60 lb. due to the weight of the wire. In the tangential suspension system the



Triple Tangential Suspension for High Speed Running.



Tangential Suspension at Section Insulators.

vertical pressure required to keep the wire in a state of suspension is transferred from the trolley wire itself to a supplementary suspension wire on which the trolley wheel does not run. The forces on the supporting ears are all tensile. In practice about 10 feet is the length of the tangential suspension measured from tip to tip of the ears, and the centre of this is about 4½ in. to 6 in. above the trolley wire.

Tangential Suspension from a Pull-Off on a Right Angle Curve.

By special designs of ears, these tangential strains are applied without distorting the evenness of the trolley wire, and bends and curves can be dealt with to any extent of pull-off without pulling the ears over sideways, or affecting the smooth running of the trolley wire.

It is recommended that the suspension wire should be 7/12, which is ample for the strains to be dealt with. The special insulator used for this system can adjust itself to any side strains there may be. Both primary and secondary insulators are of the brownware reel pattern. The lower of these supports in its groove the centre of the suspension wire, but the suspension wire is not in any way directly attached to the insulator, except where anchoring is necessary, it being free slightly to revolve the insulators when required.

The complete fittings, therefore, required for a pair of these suspensions are two special double insulators, which are of very simple design, two suspension wires, and four 8 in. ears, compared with the requirements of bracket arm work, *i.e.*, a pair of malleable cast suspension brackets, two globes, or one globe and one Brooklyn, two insulated bolts, two hangers, bow string suspension wire, and two 15 in. ears, or, if span work, less the suspension brackets, but with Brooklyns of a heavier pattern. The first illustration on the previous page shows this comparison very well.

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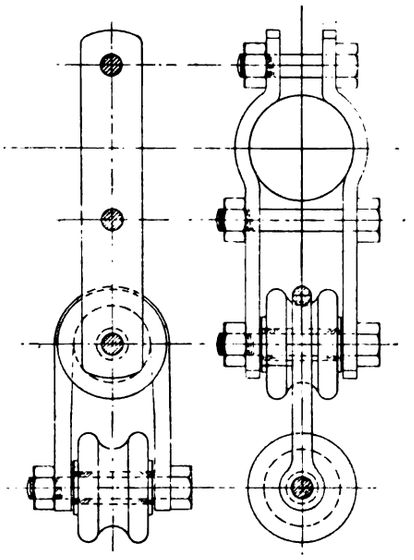
The following advantages are claimed:

1. *Very considerable increase in the vertical and horizontal flexibility at the points of support.*—Comparing bracket arm construction with flexible suspension, the average trolley tension gives a vertical motion to the end of the ear (ignoring any slight motion there may be due to springiness in the bracket arm) of about $\frac{3}{16}$ in., and the same pressure applied to the end of the ear horizontally gives a movement of about $\frac{1}{16}$ in., while with the tangential suspension method of support a flexibility of about $1\frac{1}{4}$ in. and 3 in. respectively is obtained.

Any upward motion in ordinary span construction when the trolley passes, due to the springiness of the poles, is of little avail, as the swinging and vibration on the trolley wire adjoining each ear are still practically independent of one another, and these vibrations, notwithstanding there is a certain amount of vertical flexibility, are damped out just the same at the centre of the supporting ear as with the more rigid bracket arm work: thus enabling these vibrations to exert all their deteriorating influence on the wire in the neighbourhood of this practically rigid support.



Bracket Arm Hanger.

2. *Fractured trolley wire — removal of causes.*—Owing to the increased and more uniform flexibility, the vibration of the trolley wire and the blow on the front end of the ear, due to the passage of the trolley and windage, are not damped out suddenly against an almost rigid suspension as is the case with other methods. The hingeing action of the moving trolley wire against ends of the ears which occurs equally in bracket and span construction is undoubtedly the cause of serious change in the molecular structure of the trolley wire, which, after a certain period of time, leads to its ultimate fracture. The motion of the supporting ears with the tangential suspension method, on the passage of a trolley wheel, is of an easy flexible nature, the two supporting points and the wire between them vibrating freely, and in unison with the motion of the trolley wire somewhat in the form of a floating framework, thus eliminating the above very serious defect in the present methods of suspension.

3. *Permitting of the use of a non-fouling ear with circular wire.*—In the tangential suspension system the hingeing action at the ends of the ears is removed and an entirely new class of strain is thrown on the ears both on straight line and pull-off, *i.e.*, a tensile one and one almost parallel to the trolley wire. Under these conditions it becomes practicable to use a form of ear in soldered contact with only the top half of the wire, and thus give an absolutely non-fouling ear. The strength of soldering under these strains is very great, and practical tests show that the trolley wire will part in preference to the soldering giving way.

The ears are milled out a few mils larger than the actual diameter of the trolley wire, and the latter is tinned previous to applying the ears. Two small thumb screw clamps are used for holding the trolley wire tight down in the groove of the ear during the soldering process, so that the two surfaces to be soldered are in a true and close contact, very different from what usually occurs with the ordinary soldered ear. The riveting over of the ear distorts it considerably, and the area of the wire which is actually in soldered contact with the ear is generally very small. A number of tests have been made by Mr. Pringle using 000 B and S trolley wire ·409 in. diameter and, with the 8 in. ear used on straight line work, the ear casting has broken at strains of 3,000 lb. without the ear attempting to leave the wire.

With the pull-off ears, which are about 12 in. long and of a stronger pattern, several tests have been made to prove that the trolley wire will fracture (requiring a strain of some 6,000 lb. to effect this) without any signs of the soldering giving way.

Mr. Pringle is now experimenting with malleable iron ears for soldered work. The soldering with malleable iron ears has given just as reliable results as gun metal under strains sufficient to fracture the trolley wire.

The use of a non-fouling ear on all systems equipped with circular wire is of the very greatest importance. An ear once installed on the tangential suspension system will suffer no deterioration in use, and its life therefore can be estimated as equal to that of the wire itself. In addition the sparking at the trailing end of the ear, causing local wear on the wire, is removed, and its life thereby greatly increased. With the possibility of getting an absolutely non-fouling ear on circular work future maintenance becomes reduced to a minimum, and the necessity for reverting to grooved wire is removed.

4. *Rejuvenating existing worn lines.*—In practice the best condition is found to be such that the tensile strain thrown on the trolley wire between the supporting ears is about halved, the remaining half being taken by the suspension wire. In all pull-off work, by the provision of a strain bolt, this can still be adhered to. This is of distinct advantage in the supporting of section insulators, frogs, etc., and further of very great importance where it becomes necessary to strengthen existing trolley wire, which is either weakened by wear or has been erected a sufficient number of years for a change in the molecular structure of the metal to have become sufficiently advanced to be dangerous.

By replacing ordinary suspensions under these conditions with tangential suspension, one can practically obtain a new overhead line apart from the general wear that has taken place on it.

5. *Non-deteriorating insulation.* — The form of insulator in this design of suspension, both for the primary and secondary insulator, consists of a brownware reel pattern. These insulators are applied in such a manner that they only have to carry the dead weight of the wire, and, where there is any side strain, the additional strain due to this. This allows a big margin of safety compared with the strains thrown on the same class of insulator where it has been used for secondary insulation in bow-string suspension, the strain on it in these cases being very many times greater. The insulating properties of this form of insulators in all weathers have been proved to be exceedingly high, and

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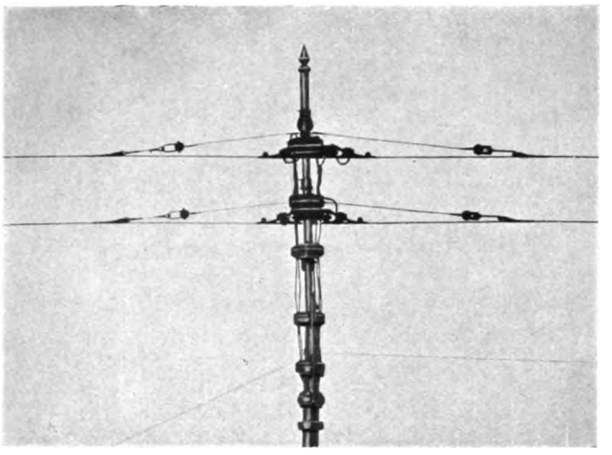
the following advantages from their use will be at once apparent:

The gradual deterioration of ordinary insulating bolts, globes, and Brooklyns, due to corrosion and electrolysis disintegrating the insulating material, is entirely done away with, and also the expense of such renewals.

Should the reel insulators meet with any mechanical damage their renewal is exceedingly simple, and the cost very small. They are exposed to the weather, and thereby kept sufficiently clean without harbouring dirt and other foreign matter, as is the case with hooded insulators, unless special provision is made to prevent this.

Previous to using the brownware reel insulator for both primary and secondary insulation, Mr. Pringle had 50 pairs of these under continuous test at 500 volts at the power-station, where they were exposed to weather and any dirt or dust that might be about. Even in very heavy rain the leakage test of these insulators showed very good results, the leakage amounting to less than 10 milliamperes, and when the rain moderated the insulation at once rose, and on ceasing soon reached about infinity. The same set of insulators have also been under test with 2,000 volts alternating for several months continuously with excellent results, so there need be no fear that an insulator entirely exposed to



Tangential Suspension on a Pull-Off at a Section Insulator.

the weather will not give satisfactory results. The same principle is now being recognised as correct for very high voltages, and it is possible that this form of insulator will, in time, supplant the petticoat form.

The following test at a pressure of 2,000 volts will show what these insulators are capable of standing under severe weather conditions:

TESTS ON 50 PAIRS BROWNWARE INSULATOR FITTINGS WHICH HAVE BEEN EXPOSED TO WEATHER FOR ABOUT 6 MONTHS.

Tests made on 2,000 volts alternating.

	Weather.	Leakage Current-Amp.
Taken over a period of about half-an-hour	Light rain	·019
	" "	·019
	Very heavy rain ..	·033
	" " " ..	·043
	Light rain	·019
	Rain stopped	·013
	One hour later	·006
	Very foggy and damp	·0063

NOTE.—The above insulators are ¼ in. smaller in diameter than those which have been adopted as a standard.

6. *Reduction of Sag.*—A straight run through is given to the trolley wire for some 10 ft. at each support, or more if desired, the effect being very greatly to reduce the variation in height of the trolley wire, and the sudden reversal of motion that occurs to the trolley wheel when ascending the sag at the front part of the ear, and then suddenly descending the sag at the trailing end. The only other alternative to reduce the suddenness of the sag in the neighbourhood of the supports is to have a trolley wire so taut that it becomes impracticable.

7. *All bends in the line and pull-offs have the angle halved*, giving much easier running, and higher speeds on bad pull-offs, and greatly decreasing the liability of derailment of trolleys. This also has the effect of minimising the side wear on the trolley wire, caused whenever there is a sudden change in the direction of motion of the trolley wheel.

8. *Cost of tangential suspension.*—This will be found, in the case of bracket arm construction, to come out about the same and, with span work, but a little more than the ordinary suspension in vogue to-day. This comparison of cost assumes that malleable iron fittings are used with the ordinary suspension. As the fittings used with the tangential suspension are mainly wrought iron or mild steel, they are comparable, as regards strength and reliability, with gun metal. If, therefore, the comparison between tangential suspension and ordinary suspension is based on the use of gun-metal fittings for the latter, then it is all the more favourable.

Where high-speed traction is in use, the present forms of suspension are not suitable. The tensile strength of the trolley wire will only permit of the reduction of the sag to a certain extent, and in addition to this, temperature variations must be allowed for. Mr. Pringle proposes to apply the tangential suspension in the form of double, triple, or more suspensions in the place of the ordinary single suspensions required for street tramway work.

One of the illustrations shows how a triple tangential suspension has eliminated the sag in a trolley wire, the adjoining one being supported on the ordinary suspension. These tests were taken on a particularly slack line for the purpose of showing the advantages to be obtained by the use of the tangential system.

The only other system which can reduce the sag sufficiently to deal with high-speed work is the catenary system. The system is obviously more costly, is of a heavier construction, requiring stronger poles, and it may yet be found that the supporting of the stranded messenger wire from an insulator at each pole, may cause some of the changes in its molecular construction previously referred to. The vertical supports in the catenary system, when high speeds are dealt with, do not give as flexible riding as might be desired. The tangential system avoids any slight blow there may be from the use of these vertical supports. Mr. Pringle believes that a double tangential suspension will give very good results on speeds of 20 to 30 miles an hour, and a triple or quadruple suspension on higher speeds than these.

Mr. George W. Green, of Messrs. G. W. Green and Company, Crown Works, Guildford Street, London, S.E., who, it may be mentioned, are the sole licensees for this system, has assisted Mr. Pringle in working out the details of this system, and in its application not only to traction work, but also to high-tension transmission lines. The Consolidated Accessories Company, of 27, Clement's Lane, London, E.C., are the selling agents for Messrs. Green.

Tramway Congress in London.—It is announced that the Council of the Tramways and Light Railways Association have decided to arrange for a Tramway Congress to be held at the Franco-British Exhibiton. The first week in July has been selected as the date, and a small committee has been formed to arrange details. Members who wish to read papers are invited to communicate with the secretary, Mr. A. de Turckheim, 35, Parliament Street, Westminster, S.W.

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THE COMMERCIAL AUDIT OF THE LONDON COUNTY COUNCIL TRAMWAYS.

Unjustifiable Payments in Relief of Rates.

Mr. W. Barclay Peat, President of the Institute of Chartered Accountants, and Mr. Francis W. Pixley, a past President, were appointed some time ago to make a commercial audit of the trading undertaking of the London County Council, and their report on the tramway undertaking was issued on March 23. The investigation covers the period from 1892, when the Council commenced expenditure on the tramways, and comes down to March 31, 1907. The document is of considerable length and highly statistical, but the following may be taken as the leading points brought out.

Capital Expenditure—Loss on the Horse System.

The total expenditure on tramways down to March 31, 1907, was:

	£
Horse traction	2,380,737
Electric	4,356,000
Total	£6,736,737

The principle of including the expenditure on horse traction in the capital account is not sound, because there are practically no existing assets to represent the horse system so far as it has been displaced. The net capital expenditure on horse tramway track was £1,027,651. For this balance no provision has been made in the tramway accounts. Parliamentary expenses and other costs totalled £77,533. These expenses were incurred by the tramway companies who were bought out, and as horse tramways are rapidly disappearing these expenses have now no value, and subject to deduction of sinking fund instalments, they represent a loss for which no provision has been made. Good-will is represented at £166,937, and this should be written off out of revenue over a shorter period than is provided by the sinking fund. The outlay on property and buildings was £773,518, and the part of this displaced by demolition or reconstruction has not been written off. The cost of horse cars was £126,232, and on it there is an estimated loss of £120,409, for which no provision has been made in the accounts, subject to the sinking fund instalments. There is an estimated loss of £55,060 on machinery and plant, subject to sinking fund deductions, and there is an estimated loss of £5,980 on harness and equipment. The combined cost of the horse and electric systems, however, appears as an asset in the capital account. While the auditors recognise that the Council had no means of writing off at once the loss on the displaced assets of the horse system, they consider that such loss should be provided for out of revenue more rapidly than by the charging of the annual instalments in repayment of the debt. Until these losses are provided for there can be no profits applicable for the relief of the rates. After making every allowance they find that the loss on the horse system, for which the Council will have to make provision, must approximate to £1,500,000, and after deducting sinking fund instalments the nett remaining loss to be met must exceed £1,000,000.

No Sum Available for Relief of Rates.

The following amounts have been applied in the relief of rates:

	£
1897-8	49,000
1899-1900	64,592
1900-1	86,000
1901-2	29,000
1902-3	45,000
1903-4	20,000
Total	£293,592

These sums were applied out of the earnings of the horse system, and the accountants consider that this money should have been reserved towards the loss referred to until the revenue of the tramways has been charged with (1) the losses on displaced assets of the horse system: (2) a full provision for renewals on the system now in force; (3) the charges in respect of the outstanding debt; (4) a proportionate amount of the full central office charges. Until all these conditions have been fulfilled the auditors are of opinion that no sum will be available for relief of rates.

Electric Traction and the Reserve Renewals Fund.

Coming to electric traction, the total expenditure on it to March 31, 1907, not including street improvements, was: power supply, £942,888; construction, £3,133,297: total, £4,076,185. The debt outstanding at the same date was £3,853,376. The expenditure is all proper capital expenditure and allocated to the proper heads. The amount at the credit of renewals reserve fund at March 31, 1907, was £141,855, of which £29,051 came from horse system profits and the remainder from electric system profits and interest. What provision should be made out of revenue for renewals is a very difficult question when the life of the assets has not yet been ascertained by experience. The Council has been advised that at least 1d. per car mile run should be provided for the renewals reserve fund, and on that basis the amount which ought to have been set aside from April 1, 1903, when electric traction begun, to March 31, 1907, would have been £182,636. The actual amount set aside in that period was £105,000. In the estimates for 1907-8 it is shown that 1d. per car mile for renewals will amount to £100,000. The provision proposed is £35,000. If this arrangement is carried into effect there will be at March 31, 1908, £142,636 short charged to revenue. The charge for renewals is, in the auditors' opinion, essentially an element in the cost of the year's trading. It should form a charge in the revenue account of each year before the balance of net revenue is arrived at. It should not be treated as an appropriation of any balance of revenue available.

A Deficiency in the Year 1906-7.

In the accounts for the year ended March 31, 1907, the surplus revenue is shown as £9,674, but if 1d. per car mile had been charged for renewals there would have been a deficiency of £58,107. It is to be noted that the result for 1906-7 was exceptional, and consequent on the working of the remaining horse systems at a loss before charging interest on and repayment of debt. Unless revenue is charged with the cost necessary to maintain the undertaking as a going concern by means of providing an adequate reserve for renewals, long before the termination of the loans periods the undertaking will become incapable of making a profit, because of the excessive repairs and renewals and the absence of an adequate fund out of which the cost could be met. Attention is drawn to the increase in ordinary repairs during the four years of the working of the electric system as shown below.

Repairs in Electric System.

Year.	Total Car Mileage.	Total Net Repairs, etc.	Per Car Mile Run.
		£	
1903-4	4,469,576	15,060	·808 pence
1904-5	10,931,396	40,988	·899 ,,
1905-6	12,164,292	57,843	1·141 ,,
1906-7	16,267,579	89,429	1·319 ,,

The inference to be drawn is that the increase in the repairs inevitably points to the need for early renewal. In the opinion of the auditors it is essential that the whole of the renewals fund should be specifically invested so as to be available when required. They find that out of the renewal fund at March 31, 1907, only £83,009 had been so invested, the balance of £58,846 having been used for the general purposes of the tramway undertaking.

Street Improvements.

With reference to the question of the allocation of expenditure under street improvements, the auditors think that the proportion of the cost of improvements and widenings which should be charged to the tramways should bear a direct relation to the benefit derived by the tramways. In assessing the benefit proportionable to the tramways the Council should be guided by the advice of experts. Examples are given of improvements of which the tramways were the cause, and yet no proportion of the cost has been allowed to fall on the tramway accounts. In other cases where it had been resolved that part of the cost of widenings should be charged to the tramways, the amount actually charged is less than that agreed upon.

The total expenditure on improvements in connection with tramway schemes up to March 31, 1907, was £752,128; of this £190,999 has been charged to tramways, and £173,690 has been contributed by local authorities; the remainder, namely, £387,439, being charged to improvement account. A substantial, but as yet unascertained, proportion of this last figure should be charged to tramways capital account. The expenditure on improvements for the purposes of general traffic amounted to £1,007,103, of which the local authorities contributed £142,982, the balance, £864,121, being charged to improvement account. In the auditors' opinion a considerable, but as yet unascertained, proportion of this latter figure should also be charged to tramways capital account.

Valuation of the Tramway Undertaking.

As to the basis of the valuation of the tramway undertakings by the valuer to the Council, dated January 16, 1907, the basis adopted of applying a multiplier to an ascertained nett income is a fair and usual basis. The number of years used as a multiplier should be arrived at after due consideration is given to the permanence and profitable character of the undertaking, and the provision made for depreciation and renewals before arriving at the nett income to which the multiplier is to be applied. The valuer fixed 25 years as his multiplier, but in so doing the auditors think he is not giving sufficient consideration to the possibility of supersession by some other system of traction, and competition by other means of conveyance

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With regard to the nett income, the valuer, in arriving at his figures for the Southern system, has not made sufficient allowance for renewals, and nothing at all for contingencies such as accidents, or possible loss by the substitution of other means of traction. 1d. a car mile for renewals would have amounted to over £50,000; the valuer only allowed £35,000. It has not yet been proved that even 1d. per car mile is an adequate provision for renewals. The auditors, therefore, consider that the nett profits upon which the valuation is based are not properly ascertained. In the case of the Northern system the valuer has not given the figure of nett income on which his calculation is based. If the nett income had been properly ascertained, the auditors consider that 25 times the amount of the annual nett income, yielding a purchaser only 4 per cent., is too high a valuation for an undertaking subject to all the risks of a tramway enterprise, and the liability to make good the roads in the event of its discontinuance. In the auditors' opinion both the multiplier and the nett income are too great.

PRESENT SYSTEM OF BOOK-KEEPING APPROVED.

In regard to the balance sheet as published, it is presented in a very clear and concise form, and the auditors have no suggestion to make for its alteration except the following: (1) That the capital total expenditure on the horse system should be shown distinct from that on the electric system; (2) instead of showing the debt repaid out of revenue as excess of assets and capital outlay over liabilities, it should appear as depreciation reserve account—total debt repaid to date, charged against revenue as depreciation of the assets of the undertaking. They further recommend that the revenue accounts should be presented in summarised form, with schedule giving details. The books of the tramway undertaking are well and carefully kept, and the accounts presented to the Council by the Comptroller are admirably prepared.

Elaborate statistical tables are appended to the report.

DISCUSSION ON THE AUDITORS' REPORT.

The Finance Committee of the Council, in presenting this report at the meeting on March 24, stated that they would give it their most careful consideration, and report fully to the Council on it as soon as possible.

On the report being submitted, there was a prolonged and excited debate.

Mr. W. HAYES FISHER, who moved the adoption of the report, said that the tramway question had been one of acute controversy between the two parties on the Council for a long time. The position of the Progressives was that while not a penny for tramways had fallen upon the rates, they had at the same time contributed a considerable sum of money to the relief of the rates, after everything had been properly charged against the accounts. On the other hand, the Municipal Reformers held that not a penny of legitimate profit had been made, that no provision had been made for a proper renewals fund, and that any so-called profits had been made at the expense of the renewals fund, and by not paying a proper proportion towards establishment charges. He contended that the report of the auditors was a vindication of the arguments of his party. At the same time, he had faith in the London County Council tramways, and that gradually they would be able to wipe out the losses on the displaced horse system, and to put by a proper renewal fund, but before this was done it would be impossible for them to carry anything to the relief of the rates.

Mr. T. MCKINNON WOOD, M.P., emphatically repudiated the idea that the audit was in any sense a proper commercial one. If they were to accept the principle that they must make up all assets from displaced horse tramways out of revenue, then they struck at the system followed by every municipality authority, and every private company in the kingdom. They knew that the Metropolitan Railway Company paid a small dividend, but at the same time there was no attempt to write off their old rails out of revenue, and they knew who the auditor of that company was. The principle now enunciated in this "commercial audit" was opposed to the law of the country, opposed to practice, and opposed to common-sense, and if carried out generally would cause a financial revolution and an industrial crisis.

A number of other speeches being made, it was agreed by a majority to place the report on sale, and to refer it to the Finance Committee for consideration.

Protection of Home Industry in Russia.—A special meeting of the Council of the "Congress of Russian Trade and Industry" on February 28 considered the question of the placing of orders for electric cars for the St. Petersburg tramways. The Town Council is about to acquire 157 motor cars and 50 trailers. It was reported at the meeting that on January 28, as the result of competition, a contract had been given to the Kolomensk factory for 100 cars for delivery in the month of June. The opinion was strongly expressed that the Russian wagon builders are quite as capable of building cars as any foreign houses, and as regards electric equipments, the names of three Russian firms were mentioned. The Council resolved to take all necessary steps to prevent orders for cars going abroad, and further to petition that in future orders for tramway cars shall be given to national builders and electrical works.

TRAMWAY AND ELECTRIC RAILWAY LEGISLATION.

SECOND READINGS.—In the House of Lords.—March 3: Metropolitan Electric Tramways. March 10: Bristol Tramways. March 17: Leith Burgh.

In the House of Commons.—March 3: North East London Railway. March 12: Liverpool Corporation (General Powers).

THIRD READINGS.—In the House of Lords.—March 24: London County Council (Tramways and Improvements).

In the House of Commons.—March 23: Rochdale Corporation.

CROYDON AND SOUTHERN DISTRICT TRAMWAYS.—On March 13 this bill was rejected on a report by the Standing Orders Committee of the House of Lords that the standing orders not complied with should not be dispensed with. The necessary consents of local authorities had not been obtained.

LEEDS CORPORATION.—This bill was passed by a Committee of the House of Commons on March 11, after a two days' hearing. The opposition was more directed to the part of the measure relating to sewerage works than to the tramway proposals. The latter provide for the construction of extensions in Horsforth, Rawdon, Yeadon and Guiseley, the total length of these lines being 5¼ miles, and the estimated cost, including an authorised line in Pudsey, which is being taken over, is £105,000.

LEITH BURGH.—In regard to non-compliance with standing orders reported in reference to this bill, the Standing Orders Committee of the House of Lords on March 13 decided to dispense with the standing orders and allow the bill to proceed.

LONDON COUNTY COUNCIL (TRAMWAYS AND IMPROVEMENTS).—This bill came before a Lords' Committee on March 18. The proposals in it are chiefly for short connecting lines. It was stated for the promoters that the only proposed tramway in the bill to which there was any opposition was a double line on the south side of the Thames connecting Blackfriars and Southwark Bridges. This tramway would carry out one of the proposals of the Royal Commission on London traffic. Southwark Borough Council wished a clause inserted in the bill providing for compensation for the removal of a public convenience and the reconstruction of it elsewhere, but it was contended that such a proposal was outside the notices given of the bill, and would, if adopted, lead to difficulties on standing orders. The Committee decided not to insert the clause, and the bill then became unopposed and passed the Committee stage.

LONDON UNITED TRAMWAYS.—The Commons Standing Orders Committee on March 18 reported on this bill that the Standing Orders should be dispensed with, and the measure allowed to proceed. Its main object is to authorise the construction of tramways across Kew Bridge, to connect the systems in Middlesex and Surrey.—The Standing Orders Committee of the House of Lords on March 25 agreed with the decision of the corresponding Committee of the Commons. The Lords' Committee, unlike the other, is open to the press, so that the circumstances submitted to it are ascertainable. Mr. Cripps, for the promoters, stated that the bill proposed the construction of tramways over Kew Bridge. The application for dispensing with the Standing Orders was made because the promoters had not obtained the consent of the County Councils of Surrey and Middlesex. Four years ago the County Councils passed a resolution, to which they still adhered, that they would give their consent if the tramways company agreed to pay a rent of £2,000 a year. This was equivalent to £5,700 per mile. He submitted that the Councils had no right under the Standing Orders to withhold their consent on condition that such terms were entered into. A bargain such as that ought to be considered by a Select Committee. On behalf of the County Councils it was contended that when they built the bridge they had made it wider than would otherwise have been necessary, with a view to tramways being at some time constructed on it. As they had incurred additional expense in that way, they contended they were entitled to make a stipulation for rent before giving their consent to the bill. The Committee, after deliberation, decided that the standing orders ought to be dispensed with. The bill will accordingly proceed in the usual way for consideration on its merits.

LONDON AND WINDSOR MOTOR ROADS, TRAMROADS, AND TRAMWAYS.—The Standing Orders Committee of the House of Lords reported on March 13 that the standing orders not complied with in respect to this bill should not be dispensed with. The bill is accordingly dead. It was the largest and most interesting traction scheme of the session.

MERTHYR TYDFIL CORPORATION.—A House of Lords Committee began consideration of this bill on March 10. Among the numerous objects of the measure is one to give power to the Corporation to run motor omnibuses between railway stations and elsewhere in the borough. This was opposed by the Great Western and Taff Vale Railway Companies on the ground that the service would not be remunerative, and that the loss would fall on the rates. It was admitted on March 11

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that some of the districts proposed to be served were already served by the railways, but the promotors contended that that service was not efficient. The railway companies replied that they gave a good service. On March 12 the Committee rejected the motor 'bus proposals of the bill.

METROPOLITAN ELECTRIC TRAMWAYS.—A Lords' Committee passed this bill on March 25. Its principal object is to extend the Harrow Road tramways to Edgware Road, part of which extension will be inside the county of London. Opposition to the measure by Willesden Urban District Council on a question of fares was disallowed. It will be remembered that London County Council propose to buy the part of the existing tramways which is in the county of London, and arrangements are to be made with the company as to running powers.

PERTH CORPORATION.—Notice has been given that the Town Council of Perth intend making application during April to the Secretary for Scotland for a Provisional Order for the extension of the boundaries of the city, for the construction of additional tramways, for power to run motor omnibuses, and for numerous other purposes.

WEST LONDON, BARNES, AND RICHMOND TRAMWAYS.—The House of Lords Standing Orders Committee reported on March 13 that though this bill did not comply with the standing orders it should be allowed to proceed. The Standing Orders Committee of the House of Commons, however, on March 17 upset the arrangement by reporting that the measure should only be allowed to proceed on condition that all tramways are struck out of it in respect of which the consents of the local authorities are not proved before the committee to which the bill is referred.

WOLVERHAMPTON CORPORATION.—This bill was passed by a House of Commons Committee on March 24 without opposition. The part of it relating to tramways seeks for an extension of time for three years for the completion of certain authorised lines. It was stated that the tramway system in Wolverhampton was highly successful financially, and that one of the new lines would serve the busiest part of the town.

RESERVE FUNDS AT LEEDS.

At a meeting of Leeds Town Council a special committee reported on what reserve funds should be provided in addition to sinking fund in connection with the tramways, electricity, and gas undertakings of the Corporation. The Committee's resolution was that a maximum of £25,000 should be provided in respect of each undertaking, and that £4,000 and £3,000 should be paid forthwith to the tramways and electricity funds. Ald. C. H. Wilson, chairman of the Finance Committee, in moving approval of the report, said that the undertakings, and especially the tramways, were regularly and heavily renewed year by year, and it was clear they had only two other contingencies to provide for, viz., any loss that might be incurred on the year's working—which, so far as the tramways were concerned, was very remote—and serious accidents. In the electricity department they had "scrapped" a great deal of old plant, and no doubt the chairman of that department would argue that there was still more to be dealt with in the same way. But there was no reason why that should not be done out of current revenue. In the matter of the tramways, the general manager had said that if he was allowed regularly to relay so much of his lines as he thought necessary, and to renew cars and other property as he was now in the habit of doing, he would require no reserve fund. But for possible accidents a reserve would be useful. Renewals were not set against reserve. The proposal to set up a reserve fund for each of these undertakings, with a maximum of £25,000, was in his opinion quite adequate.—Ald. Matheson said that big inventions were coming along in the matter of tramways, and these the Corporation would be obliged to adopt. In ten years' time there would not be a corporation which would allow overhead conductors. He also contended that £25,000 for the electricity department was entirely insufficient.—The report was adopted.

Messrs L. P. Winby and Company have recently received a repeat order for Winby patent anchor chairs from the Sheffield Corporation. Winby patent soleplates have also been supplied to Wolverhampton, Sunderland, Bath, and Nottingham.

"**Reactions**" is the title of a monthly publication devoted to the science of alumino-thermics, which is issued by the various companies representing the Goldschmidt welding process. The first issue is a well-illustrated and interesting publication of 24 pages, for a copy of which we are indebted to Thermit, Limited, of 27, Martin's Lane, London, E.C. Since the formation of the company in 1904, the process has been much discussed in the technical papers, and it is now well known, so that the idea of the publication of "Reactions" is not to secure publicity, but to keep the customers of the company regularly informed of the most up-to-date practice. An interesting series of illustrations shows the process of repairing a tramway motor case. Thermit, Limited, now have arrangements in London for carrying out expeditiously repair work of this description.

LONDON COUNTY COUNCIL TRAMWAY MATTERS.

At a meeting of the London County Council on March 3, a number of reports were submitted by various committees on the

Reduction of Estimates.

A general report on the subject was presented by the Finance Committee, in which they stated that it had come under their notice some months ago that there were many capital votes outstanding in respect of which savings had been, or were expected to be, made, and it appeared desirable that the amounts of these votes should be reduced to the extent of the amounts which it was considered would not be required. The Committees concerned were now making recommendations reducing the estimates by a total sum of £2,525,562. The savings relate to a period of many years.

The Highways Committee, in their report on the subject, said that the total of the savings on tramway work was £554,359. The various estimates concerned dated from January, 1900, on to the present time, and the total amount of the estimates was £4,211,225, and this was now reduced by the savings already named to £3,656,866. The various cancellations involved were recommended for adoption, and this was approved.

Completion of the Tramway Subway.

The Highways Committee reported that they had considered the arrangements to be made for the through running of electric cars between north and south London consequent on the completion of the subway tramways from Aldwych to the Victoria Embankment. They proposed that in the first instance services of cars should be instituted between Highbury (North London Railway) Station and the Tower Bridge, and between Highbury Station and Kennington Gate. A list of fares for these routes was submitted for approval, and the Committee also proposed that workmen's fares (1d. single, 2d. return) should be issued in cars travelling in either direction to Waterloo Bridge on the Embankment, but they were of opinion that that point should be made the limit for the issue of workmen's tickets on through cars travelling between north and south London. When car services were run over Blackfriars Bridge there would be no terminus on the Embankment, and Waterloo Bridge would then form the natural fare limit and dividing point for cars travelling to Blackfriars Bridge and Westminster Bridge.

The recommendations were adopted.

District Depôt Superintendents.

In view of the considerable extension of the tramway system and the increasing amount of work at the various depôts, it had, the Committee reported, become necessary to supplement the present staff of depôt foremen by the appointment of district depôt superintendents, whose duties would include the supervision by night and day of the cleaning and maintenance of electric rolling stock. The rate of pay of £3 10s. to £4 10s. a week was fixed for the district depôt superintendents.

Rebuilding of Two Bridges.

At a meeting of the Council on March 10, the Highways Committee reported on tenders which had been received for the re-building of bridges carrying Caledonian Road over the Great Northern Railway and the Regent's Canal, in connection with the electrification of the tramways. The tenders varied in amount from £6,895 to £10,601, while the chief engineer's estimate was £7,842. The Committee recommended and the Council agreed that the lowest tender, namely that of Dick, Kerr and Company, Limited, should be accepted, and that that firm should be allowed to sub-let the supply of the steelwork. The estimate included £2,275 for contingencies and extra works, the whole of which might not be required.

Tenders for Track Rails.

The Committee recommended acceptance of a tender by Walter Scott, Limited, of £3,978 for the supply of about 525 tons of track rails and fastenings required for the reconstruction of tramways from Brixton Road to Camberwell Green, and that that firm be allowed to sub-let to the undermentioned firms the following portions of the work: (1.) Coghlan Steel and Iron Company, fish plates; (2.) Guest, Keen and Nettlefold, bolts and lock nuts. Two other tenders had been received, namely, Bolckow, Vaughan and Company, £4,053; Barrow Hematite Steel Company, £5,062. The chief engineer's estimate was £3,876. The recommendation was adopted.

Proposed Purchase of Highgate Hill Tramways.

The Council approved a report, in which the Committee stated that they had had under consideration for some time the question of the purchase of the Highgate Hill tramways undertaking. These lines were of narrow gauge and were worked by cable traction, and they consisted of about ¾ of a route mile, partly double and partly single track, situated in London and Hornsey. The tramway company had introduced a bill into Parliament in the present session to authorise them to reconstruct the tramways for electric traction on standard

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gauge, to postpone the date of compulsory purchase, and to confer on the company running powers over parts of the Council's tramways. Steps are being taken by the Council to oppose the bill. The company had, however, approached the Highways Committee with a view to the purchase by the Council, at an early date, of the whole of the company's undertaking by agreement, in which event the company would not proceed further with their bill. The company had now expressed willingness to sell the lines, etc., on terms which the Committee would feel justified in recommending the Council to accept. It was accordingly proposed that a special meeting of the Council should be held to consider the matter as soon as practicable.

ANNUAL APPOINTMENTS.—NEW HIGHWAYS COMMITTEE.

Mr. R. A. Robinson was elected chairman of the Council for the ensuing year, and Mr. W. Whitaker Thompson, hitherto chairman of the Highways Committee, was appointed vice-chairman of the Council. The various committees were appointed, including the Highways Committee constituted of the following members: George Alexander, Sir R. M. Beachcroft, A. Shirley Benn, Sir John Benn, H. J. Glanville, F. Hall, Captain the Hon. Fitzroy Hemphill, the Earl of Kerry, P. E. Pilditch, A. Pownall, W. J. Squires, W. Burton Stewart, Lord Alex. Thynne, Henry Ward, D. S. Waterlow, and H. J. William.

At a meeting of the Council on March 17, the Highways Committee reported that they had elected Mr. W. Whitaker Thompson chairman, and Mr. A. Shirley Benn vice-chairman for the year.

NEW CONTRACTS.

The Committee reported that consideration had been given to the undermentioned tenders for the manufacture and supply of points and crossings for the junctions, etc., required for the reconstruction of the overhead wire system of the tramways from Brixton Road to Camberwell Green:

	£	s.	d.
Lorain Steel Co., Ohio, U.S.A.	833	10	0
Hadfield's Steel Foundry Co., Sheffield	838	12	6
Edgar Allen and Co., Ltd., Sheffield	888	10	0

The chief engineer's estimate was £810. The Committee found that the tender of the Lorain Steel Company was on the basis of the Council supplying to the company, free of charge, wrought rails for use in manufacturing the crossings required, instead of these being made of cast steel in the usual manner. The value of these rails would be about £35, thus making the Lorain tender about £30 higher that that of Hadfield's Steel Foundry Company. Moreover, the Lorain Company could not deliver the special work by the time required. In these circumstances the Committee recommended acceptance of the tender of Hadfield's Steel Foundry Company.

The proposals were adopted.

TRAMWAY RECONSTRUCTION IN BATTERSEA.

At a meeting of the Council on March 24, the Highways Committee reported that it was proposed to include among the tramway works to be undertaken during the year 1908-9 the reconstruction of the remainder of the lines of the South London Tramways Company, comprising tramways from Nine Elms Lane to East Hill, Wandsworth, and from Lavender Hill, *via* Queen's Road, Battersea, to Chelsea Bridge. The Committee were of opinion that steps should be taken at once for the electrification of the lines on the Queen's Road route. The estimated cost on the conduit system was as follows: Trackwork, etc., including special work and £7,100 for rails, £46,500; cables, etc., £1,223; cable ducts, etc., £1,040; rolling stock, £4,250; total, £53,013. Owing to the low headway of certain railway bridges it would only be practicable to run single-deck cars on this route. The Council already had a sufficient number of single-deck cars for the purpose. Approval was asked for an estimate of £39,400 (excluding rails which were already provided for) and £1,040 for cable ducts. It was also proposed that expenditure of £7,916 be sanctioned for slot and conductor rails and special track work, and that arrangements be made with the undermentioned firms for the extension of their present contracts: Frodingham Iron and Steel Company, slot rails and conductor rails; Hadfield's Steel Foundry Company, special track work. The probable cost of the special work was £5,283. With regard to obtaining electric cables for the whole of the tramway works to be put in hand during the coming financial year, the Committee were advised that the present price of copper was very low, and was not likely to fall much below the present rate. It would be of advantage to obtain the cables as soon as possible, so as to get the benefit of the present state of the market. Tenders had been invited, and the total estimated cost was £78,900.

Consideration of these proposals was postponed.

TRAMWAY SUBWAY.

The Committee reported that they had arranged for inspection of the tramway subway from Aldwych to the Victoria Embankment, and the tramways therein on April 10 next, previous to the opening of the line to the public.

ADDITIONAL CARS.

It was agreed, on a proposal by the Committee, that steps should be taken to obtain the additional electric rolling stock required for the tramways to be reconstructed in the near future. Tenders will be invited for the supply of 175 bogie-truck, double-deck cars, fitted with roof covers and draught screens.

SUPPLEMENTAL MAINTENANCE ESTIMATES.

Approval was given to supplemental maintenance estimates, for the year now closing, amounting to £80,935, by which sum the working expenses exceeded the maintenance votes for the year. The excess, the Highways Committee explained, was caused by a greater distance being run, increased assessments for rates, increased workmen's compensation, and to the fact that some routes were in operation by horse traction for longer periods than had been anticipated. It was expected that the traffic receipts also would exceed the amounts included in the estimates by about £93,000, and that to some extent the extra expenses would be counter-balanced by savings under other heads.

FINANCIAL COMMENT.

The fall in the Bank rate to 3 per cent., which took place on March 19, did not sensibly improve prices, and the stock markets made only a slight response to the reduced value of money until, as the result of the by-election at Peckham, a sense of greater security in the established order of things was experienced. The stimulus thus afforded is not yet spent, but has so far failed to penetrate the region of electrical manufacture and traction enterprise. How far the recovery may go is hard to judge. The prices of existing stock cannot rise freely while there are so many new issues impending, and the high rates prevalent for underwriting show clearly that these will not be absorbed with avidity. The underwriting fraternity are known to be somewhat heavily loaded already, and in many instances of late have been glad to sacrifice some fraction of their percentages in order to release capital, or even to submit to loss with this object. Numbers of investors have thus discovered that however tempting may appear the offer of a new issue of stock it frequently is to be had cheaper by waiting. Having waited to scan quotations, his first enthusiasm spent, an investor soon becomes comparative and hard to please.

THE GOLD RESERVE.

Our reserve of gold has been a subject of acrimonious discussion to many generations of men. In easy times little is heard of it, but when, as of recent years, the Bank rate is put up, and the whole trade and industry of the country made to pay very high rates for money in order to preserve it from exportation, the talk begins anew. The only points upon which everyone is agreed are first, that the present position is unsatisfactory, second, that it would be less so if the reserve were increased. The public generally seem to think that the joint stock banks should keep larger reserves in their own vaults. The joint stock banks prefer to rely, as before, on the Bank of England. The Bank of England return silently reminds us the Government owe it eleven millions. The Government think the banking world ought speedily to come to some arrangement settling the matter out of its own resources. The banking world point out the Government is the biggest banker of them all, owing some 200 millions sterling to its depositors in the savings banks, which are not only without a gold reserve, but are not even solvent. The protagonists of the savings bank department say it cannot be compared to other banking institutions, and does not attempt to work at a profit. However, in the event of an invasion or any real catastrophe, the people would probably want their money in a hurry. It is quite time something was done.

MERSEY RAILWAY COMPANY.

The accounts of the Mersey Railway Company for the half-year ending December 31, 1907, show a moderate, and, on the whole, an encouraging improvement. The gross receipts are nearly 7 per cent. greater and, although the expenses have also increased, it has been to a smaller extent, so that the balance at the revenue account is nearly 20 per cent. better than for the same six months of the previous year.

The actual amount is £13,719, not sufficient to meet the fixed charges. Indeed, the improvement in earnings must be very much more marked before the shareholders can expect any appreciable benefit. There is a balance at debit of net revenue account now amounting to £8,481, and capital acount is overdrawn by £13,198. Fortunately there is to be no further capital expenditure; account No. 7, devoted to estimates of this, presents a pleasing blank.

The changes in the items of expenditure in the revenue account have not been very important during the half-year under review. Some £700 representing the increased cost of fuel was almost exactly balanced by economies in maintenance and renewal of permanent way; the remainder of the increase in expenditure was fairly evenly distributed, except for the fact that another £800 went in law costs which came to £1,361. The report does not mention the nature of the legal expenses, but the manner of providing for depreciation, which we will next examine, will perhaps afford a clue.

Debited to maintenance of way and works is £500 for renewal fund, and the same item appears in the account of locomotive and generating power expenses.

(Continued on page 281.)

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TRAMWAY AND OMNIBUS SHARES.

Specially Compiled for "The Tramway and Railway World."

Amount Ranking for Dividend.	Shares.	Name.	Div'd. Prev. Half-year.	Div'd. Last Half-year.	Quotations, Mar. 26.	Latest Business Done. Price.	Latest Business Done. Date.	Yield on Buying Price. £ s. d.	Dividend Due.*	Quotations, 1907. Highest	Quotations, 1907. Lowest.
260,007	5	Anglo-Argentine Tramways 6% Cum. 1st Pref.	10%	8%	6 6¼	6 1/16	Mar. 26	4 16 0	*Apr., Oct.*	6½	5 29/32
320,000	5	Do. do. 10% Non-Cum. 2nd Pref.	5½%	5½%	8—8¼	8 3/32	Mar. 26	6 1 3	*June, Dec.*	8	7½
135,000	1	Associated Omnibus Ord. ...		7⅛d.	1/16—3/16	...	...	...	...	...	...
75,606	1	Bath Electric Tramways Pref. Ord.	5%	for '06	9/16—11/16	13/-	Mar. 5	7 5 6	*Apr., Oct.*	1	¾
75,000	1	Do. do. 5% Cum. Pref.	5%	5%	13/16—15/16	16/3	Mar. 7	5 12 9	*Jan. & July*	1	13/16
15,000	10	Blackpool and Fleetwood Tramways	9/-	4/-	12⅛—12⅜	12⅜	Mar. 25	5 5 3	22 Aug.	...	...
100,000	16/-	Blackpool, St. Anne's, and Lytham Ord.		...	—⅛	...	...	...	...	...	...
50,000	18/-	Do. do. do. 5% Cum. Pref.	..		⅛—¼	...	...	..	...		...
60,000	10	Bombay Electric Supply & Trys Co. 6% Cum. Pref.	4/8·377	5/2·176	9¾—10¼	10	Mar. 16	5 17 3	Feb., Aug.	8⅜	7⅞
75,000	5	Brisbane Electric Tramways Investment Co. Ord.	2/-	2/-	3⅞—4⅛	79/4½	Mar. 25	2 8 6	*May.*	3 7/16	1 11/16
75,000	5	Do. do. do. 5% Cum. Pref.	5%	2/6	4¾—5	98/9	Mar. 24	5 0 0	*May, Nov.*	5 1/16	4 9/16
50,000	10	Bristol Tramways and Carriage Co....	8½	9½	11—11½	13	Feb. 20	7 16 6	*Feb., Aug.*	15¼	14
50,000	10	Do. do. do. 4% Cum. Pref.	4	4	8¼—8¾	9	Feb. 20	4 11 6	...	...	...
400,000£	Stk.	British Columbia Electric Railway Def. Ord.	8%	for '07	130—133	132	Mar. 26	5 12 9	May, Nov.	135	122½
300,000£	Stk	Do. do. Pref. Ord.	6%	for '07	108—112	110	Mar. 23	4 18 3	May, Nov.	116½	105
300,000£	Stk	Do. do. 5% Cum. Perp. Pref.	5%	for '07	105—109	108	Mar. 24	4 12 9	May, Nov.	110¾	101
131,301	10	British Electric Traction Ord.	6/-	for '06	1⅛—1⅜	26/3	Mar. 25	...	Apr., *Oct.*	4 17/32	1¼
161,437	10	Do. do. 6% Cum. Pref.	6/-	...	4—4½	81/3	Mar. 26	...	Feb., *Aug.*	8½	4¼
100,000	5	Buenos Ayres and Belgrano Electric Trys. Ord.	3/-	for '07	4⅝—4⅞	93/9	Mar. 10	3 1 6	*Apr.*. Oct.	4 9/16	2 31/32
40,000	5	Do. do. "A" 6% Cum. Pref.	6%	3/-	4⅝—5⅛	5	Jan. 22	5 17 3	*Apr.*, Oct.	5½	4¾
27,500	5	Do do. "B" do.	6%	3/-	4⅝—5⅛	5	Feb. 10	5 17 3	*Apr.*, Oct.	5⅜	4¾
113,436	5	Buenos Ayres Grand National Tramways Ord.	...	...	2⅜—2⅞	50/-	Mar. 7	...	*Jan.*	3⅜	2
90,000	5	Do. do. do. 5% Cum. Pref.	3/-	2/6	3¾—4¼	80/-	Mar. 23	5 17 9	...	4¾	3¾
137,610	5	Calcutta Tramways Ord.	7%	3/6	6¾—7¼	6 43/32	Mar. 23	5 14 6	*Apr.*, Oct.	8 15/32	6⅜
30,000	5	Do. 5% Cum. Pref.	5%	2/6	5—5⅜	5 3/16	Mar. 14	4 13 0	Jan., July	5⅜	5 1/16
491,222	1	Cape Electric Tramways	6d.	for 05	3/16—7/16	4/4½	Mar. 17	...	Feb., *Nov.*	9/16	⅝
15,000	10	Carthagena and Herrerias Steam Tramways	7/-	6/-	4—5	91/3	Mar. 18	16 0 0	*June*	11¼	6 31/32
40,000	5	City of Birmingham Tramways 5% Cum. Pref.	10%	2/6	4⅜—4⅞	5 3/32	Mar. 4	5 5 3	*Apr.*, Oct.	5½	4 9/16
248,000	5	City of Buenos Ayres Tramways (1904)	5%	1/3	5 1/16—5 7/16	5 3/16	Mar. 26	4 12 0	*Apr.*, Oct.	5½	4 29/32
60,000	1	City of Carlisle Electric Tramways	1¼%	for '06	2/3—2/9	...	...	...	*Feb.*	...	...
5,000	10	Clontarf and Hill of Howth Tramways		1%	6—6¼	6¼	Feb. 5	...	...	...	...
11,500	10	Cork Electric Tramways and Lighting Co.	10/-	ann.	9¼—9¾	...	...	5 2 9	*Mar.*	9¾	8¾
12,327	10	Do. do. do. 5% Cum Pref.	5/-	5/-	9¾—10¼	10	Feb. 26	4 17 9	Jan. 1. Dec. 30	...	...
3,000	10	Dublin and Lucan Electric Railway 5% Cum. Pref.	5/-	5/-	...	...	...	...	Sep. 15. Aug. 29	...	...
1,900	10	Do. do. do. Ord.	...	...	3½	...	...	...	...	...	...
60,000	10	Dublin United Tramways Co. (1896), Ltd., Ord.	6/-	7/-	12¼—13¼	13⅛	Jan. 29	4 18 3	Feb., Aug.	15	12⅞
59,987	10	Do. do. do. 6% Cum. Pref.	6/-	6/-	12½—13½	12 13/16	Mar. 19	4 9 0	*Feb.*, July	14 13/16	12⅞
40,000	5	Hastings and District Electric Trys. 6% Cum. Pref.	...	4/-	4—4¼	82/6	Mar. 4	7 1 3	...	102	97
20,000	10	Imperial Tramways Ord.	8	10	10¾—11¼	11¼	Feb. 20	8 0 0	...	...	...
20,000	10	Do. 6% Cum. Pref.	6	6	9¾—10¼	10⅜	Feb. 20	5 17 3	...	...	...
30,000	5	Isle of Thanet Elec. Trys. & Ltg. Co. 5% Cum. Pref.	...	1/3	⅞—1⅜	20/-	Feb. 17	...	*Mar.*, Sept.	...	...
250,000	1	Kalgoorlie Electric Tramways	...	...	1/16—⅛	...	...	...	*May*	2½	1
28,723	10	Lanarkshire Tramways	5/6	6/-	9¾—10¼	10 1/16	Feb. 20	5 12 3	Feb., Aug.	5/16	1/16
594,188	1	Lisbon Electric Tramways Ord.	5	1/-	15/16—1 1/16	20/-	Feb. 15	4 14 3	*July.*	10½	9¾
425,553	1	Do. do. 6% Cum. Pref...	6	7½d.	15/16—1 1/16	...	...	5 13 0	*July.*	1 1/32	31/32
773,592£	Stk.	London General Omnibus Ord.	5%	...	27—33	29	Mar. 26	...	Mar., Sept.	1 5/16	¾
25,000	10	Do. do. 5% Cum. Pref	5%	5/-	4—5	91/3	Mar. 20	...	Jan., July.	82	37
60,007	1	London Motor Omnibus Ord.		1/4	...	...	...	...	...	9½	4½
40,000	5	Do. do. 6% Cum. Pref.	...	2/2	...	...	...	...	...	...	...
74,000	6	London Road Car...	2/6	for '06	1—1½	25/-	Mar. 24	...	Feb., Aug.	3¾	2 9/16
5,471	10	Do. 5% Cum. Pref.	5/7¼	5/-	5—7	6	Feb. 3	7 2 9	Feb., Aug	...	...
31,000	4	London Street Tramways	2/-	2/6	7/16—9/16	...	...		*Mar.*	11/16	⅝
125,000	10	London United Trys. (1901), Ltd., 5% Cum. Pref.	2	5/-	6½—7½	7 1/16	Mar. 4	6 13 6	*Jan.*, July.	9½	7⅞
22,900	5	Manx Electric Railway 5½% Cum Pref.	5½	2/9	4½—5	...	...	5 10 0	June, Dec.	5⅛	4⅞
314,016	1	Metropolitan Electric Tramways Def.	..	...	1/16—3/16	2/3	Mar. 9	Nil		3/16	1/16
500,000	1	Do. do. do. 5% Cum. Pref.	6d.	6d.	¾—⅞	15/-	Mar. 26	5 4 3	*Feb.*, Aug.	1	¾
$6,000,000	$100	Mexico Tramways Common Stock	2%	$1	75½—77½	76	Mar. 25	5 5 6	Feb. 1. May 1 Aug. 1, Nov. 1	...	...
50,000	5	New General Traction 6% Cum. Pref.	...		½—1	...	...	...	Jan., *July.*	1¾	¾
110,923	4½	North Metropolitan Tramways	1/-	...	⅛—⅜	5/-	Mar. 10	...	...	...	...
5,000	10	Oldham, Ashton, and Hyde Electric Tramways Ord.	7/-	5/-	8¾—9¼	9⅜	Mar. 23	6 9 9	...	...	...
5,000	10	Do. do. do. 5% Cum. Pref.	5%	5%	8—8¼	...	...	6 1 3	...	.	...
100,000	1	Perth (W.A.) Electric Tramways Ord.	5%	5%	9/16—11/16	...	...	7 5 6	*Mar.*	11/16	9/16
245,000	1	Potteries Electric Traction Ord.	4	for '07	5/16—7/16	...	.	9 3 0	*Mar.*	⅝	⅜
245,000	1	Do. do. 5% Cum. Pref.	5	6d.	½—⅝	10/9	Mar. 16	8 0 0	*Feb.*, Aug.	11/16	½
24,912	10	Provincial Tramways Ord.	3/-	5/-	4½—5	4⅞	Jan. 23	8 0 0	*Dec.*	5½	4½
10,000	10	Do. do. 6% Cum. Pref.	6/-	6/-	9½—10½	10 1/16	Feb. 11	5 14 3	June, *Dec.*	11	10¼
30,000	5	Rangoon Electric Trys. & Supply Co. 6% Cum. Pref. ...	...	3/-	5—5½	5⅜	Mar. 2	5 9 3	June, Dec.	5¾	5
250,000	$100	Rio de Janerio Tramways Light and Power Co....	...	...	37—38	37 13/32	Feb. 5	...	...	...	..
91,000	$100	Sao Paulo Tramway, Light, and Power	$2¼	$2¼	121—125	124	Mar. 20	6 17 6	*Apr.*, Oct.	144½	101
6,343	10	Snowdon Mountain Tramroad Ord.	...	...	7—8	...	...	...	...	...	...
169,570	1	S. Metropolitan Elec. Trys. & Ltg. Co. 6% Cum Pref.	6⅜d.	7⅛d.	15/16—1 1/16	19/-	Mar. 3	5 13 0	Feb., Aug.	1 1/32	⅞
3,900	5	Southport Tramways	4/-	...	3—3⅛	...	...	...	...	...	...
30,000	5	Star Omnibus 5½% Cum. Pref.	...	...	½—1	...	...	...	*Jan.*, July.	1½	¾
40,000	5	Yorkshire (West Riding) Elec. Trys. Ord.	...	...	1—1½	...	..	...	*Mar.*	1 9/16	1
46,261	5	Do. do. do. 6% Cum. Pref.	...	...	3—3½	72/6	Jan. 22	...	*Mar.*	4	3⅛

ELECTRIC RAILWAY SHARES.

1,853,610£	Stk.	Central London Ord. Stock	3	3	68—71	70	Mar. 26	4 4 6	*Feb.*, Aug.	82¾	54½
1,480,000£	Stk.	City and South London Co's. Ord. Stock	2½	1¾	37—39	38¾	Mar. 26	5 9 0	*Feb.*, Aug.	50½	39
78,000	10	Great Northern and City Pref. Ord. 4%	11½d.	...	1—1½	25/-	Mar. 26	...	*Feb.*, Aug.	3¾	1⅛
159,000	10	G.N., Piccadilly, and Brompton Ord.	4/-	4/-	5½—6½	6⅛	Mar. 11	6 3 3	*Feb.*, Aug.	8	4
500,000	10	Liverpool Overhead Ord.	...	...	1⅜—1½	29/6	Feb. 27	1 13 6	*Feb.*, Aug.	2	1¼
1,412,263£	Stk	Mersey Cons. Ord. Stock	...	...	2—4	...	...	Nil	*Feb.*, Aug.	7	2
5,732,062£	Stk.	Metropolitan Cons.	½	½	40—41	40⅜	Mar. 26	1 4 6	*Feb.*, Aug.	60¼	31½
3,235,000£	Stk.	Metropolitan District Ord.	...	...	10½—11½	11 5/16	Mar. 26	Nil	*Feb.*, Aug.	19¼	7¼
2,499,200£	...	Unde ground Electric Railways Co. of London, Ltd., 5% Profit-sharing Secured Notes.	5	ann.	40—44	42	Mar. 19	11 7 3	*June*, Dec.	89	34

* Date of final payment is given in italics.

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This provision of £1,000 has been made for several half-years and, amounting as it does to £2,000 a year, would be a praiseworthy recognition of what good finance requires, considering the unprofitable business of the Mersey company, were it not that it has apparently been made at the expense of the contractors. The net revenue account is credited with £3,808 payable by the British Westinghouse Electric and Manufacturing Company, and a note is appended in which it is stated that the latter company do not admit the two sums of £500 carried to the renewal funds before mentioned. The improvement in receipts has been confined almost entirely to passenger traffic, and has here approximated to 10 per cent. in all classes. The gain was least marked in the second-class passengers, as usual, in fact the receipts from this class were almost stagnant and amounted to barely £1,000. Were it possible for the company to raise its fares without a more than equivalent reduction in the number of passengers carried, there would be a better prospect of an adequate return to the shareholders for the capital invested in the enterprise.

THE BRISTOL TRAMWAYS AND CARRIAGE COMPANY, LIMITED.

This is one of the most successful tramway undertakings in the country, and has just applied to the public for more capital, its accounts, therefore, for the year 1907 which have now appeared deserve particular attention. Rather fewer passengers were carried than in the preceeding year, the figures being 46,585,050 as compared to 46,902,257, and the receipts were consequently not quite so good by £2,488. The remarkable activity in trade of last year was therefore of no benefit to the company in respect to traffic, while on the other hand it acted adversely upon the expenditure, by increased cost of materials. General expenses, and horsing and traffic expenses, came to rather over £2,000 more, and although repairs and maintenance were slightly less, there was a still greater diminution in sundry receipts, so that the balance of net revenue is nearly £5,000 less at £85,347.

It is unusual to find that a saving in maintenance expenses is practicable in a tramway undertaking in a stage of its history when the influence of wear and tear is beginning to tell, and the permanent way requires renewal in miles at a time; but in this case there are handsome reserves amounting to £179,826 in all to fall back upon, which have been accumulated for the purpose, so £10,195 was paid out of that for renewals of permanent way, which is about half as much again as the interest accrued to the reserve. It is specially worthy of attention that the whole of the reserve is separately invested in securities set out, and that the amount is annually written down to the market values of the securities. Last year £7,090 went in compliance with this procedure, and the year before £4,908, so the path of financial rectitude has been steep and narrow.

The stocks and shares in which the reserve has been invested have, on the whole, been well selected, though it is perhaps a criticism that local undertakings and cognate businesses have been too much favoured, but the directors cannot be blamed for confining themselves to the securities with which they are best acquainted.

The report might with advantage be a little less reticent in statistical information. The only figures given relate to the passengers carried.

THE GLASGOW DISTRICT SUBWAY COMPANY.

The total receipts of this compay from traffic for the half-year ending December 31, 1907, amounted to £34,795 against £33,406 for the corresponding period of the previous year, an improvement of more than four per cent. which was earned on less than one per cent. additional train-mileage. The profits should therefore have been better, but instead of this they were £17,068 against £18,416, and this diminution resulted in the ordinary shareholders receiving but half per cent. instead of one per cent. There were, of course, the intervening rights of preference shareholders to account for so magnified a reduction. The disproportionate increase in expenses may be ascribed partly to the extra cost of coke and coal £634, and of fuel, lighting, and general stores £360, but chiefly to cable repairs and renewals £1,000. The remaining increases are fairly well distributed, and no more than the extra traffic would suffice to account for. Railways of this kind when once past the period of their first youth are very apt to afford their shareholdets unpleasant surprises in the particular of renewals to plant and equipment, when adequate reserves to that end have been neglected.

In this case the balance sheet shows no reserve for renewals, though there is a general reserve fund of £3,795, which has no doubt been set aside from profits available for distribution.

The capital expenditure during the past half-year was only £602, which was charged against this general reserve fund, and it is satisfactory to note that no further capital expenditure is contemplated either during this half-year or in the future; but there is a debit to capital account of £166,455, and the amount due on sundry outstanding accounts exceeds the amount to be received under the same heading by £4,874. So in spite of the fact that progress is considerable, the passengers carried being nearly double, and the receipts therefrom almost half as much again as in 1898, some further issue must be expected sooner or later.

THE LIVERPOOL OVERHEAD RAILWAY.

This enterprise is in many respects comparable to the Glasgow Subway Company, but the position is financially better. The receipts for the last half-year amounted to £40,135 from passenger traffic, against £39,028 for the corresponding period in the previous year, an increase of 4½ per cent.; 471,076 more passengers were carried with the running of 23,302 less train miles, a saving of 5·3 per cent., though an extra 1,850 car miles were done on the tram lines. In these circumstances the results of working were naturally more profitable, though not all that might have been expected, which the directors in the report say is *mainly* owing to the additional cost of coal and stores. This is true, coal and coke came heavier by £655, at £2,803, while oil, tallow, and other stores were £413 more, at £1,284, but they might have added that the cost of maintenance of way and works was greater by £817, and so largely contributed to the increase in expenditure. The balance of net revenue is, however, better by £506, being £9,104, against £8,598 for the year before; so with the help of £274 deducted from the amount carried forward, the ordinary shareholders are able to receive ½ per cent. instead of nothing at all. Some £500 only had been expended on capital account, and £2,500 more is all that is contemplated in the future. £1,000 during the ensuing six months, and the rest later.

The balance sheet looks fairly healthy. Capital has been overspent by £23,404, being borrowed from the renewal fund, which amounts to £35,062, but there is £20,541 cash and investments of £5,000, so the undertaking can probably get along for some time yet without requiring further money.

FINANCIAL REPORTS AND COMPANY MEETINGS.

South Shields Tramway Managership.—The question of the tramway manager being asked to terminate his engagement again came before South Shields Town Council on Monday, but consideration was adjourned.

Hadfield's Steel Foundry.—A dividend has been declared for 1907 at the rate of 15 per cent., with a bonus of 2½ per cent., making 17½ per cent. The distribution for 1906, including bonuses, was at the rate of 25 per cent.

Melbourne Tramway and Omnibus Company. - The London secretary has received cable advice of the declaration of a dividend for the quarter ending the 31st inst. at the rate of 4½d. per share (equal to 15 per cent. per annum), payable April 1.

Sao Paulo Tramway, Light, and Power.—The British Empire Trust Company, registrars and general secretaries in Europe for the above company, notify that the company have declared a quarterly dividend of 2¼ per cent. on the capital stock.

British Insulated and Helsby Cables, Limited.—For the past half-year the directors recommend a dividend of 4 per cent. and a bonus of 2 per cent., making 10 per cent. for the year. The sum of £37,000 is set aside to reserves and depreciation, and £28,000 carried forward.

Stewarts and Lloyds.—The directors have declared, after setting aside £70,000 for depreciation, a dividend for the half-year ended December 31 last at the rate of 11 per cent. per annum on the ordinary shares, placing £30,000 to reserve fund, and carrying forward £72,000.

Burnley Corporation Tramways continue to show excellent results. For the past year there has been an increased revenue of £2,000, and a decrease in working expenses of nearly £1,500. The profit amounts to £10,000, and this sum has been added to the reserve and depreciation fund.

London Street Tramways Company.—The report of the directors shows that the amount standing to the credit of revenue account is £4,128. Out of this sum the directors propose the payment of a dividend of 2s. 6d. per share. This will leave a balance of £254 to be carried forward.

Energy Costs at Yarmouth.—Yarmouth Tramways Committee propose again to petition the Electricity Committee to reduce the price for energy supplied for the tramways. The price at present is 1¾d., and during the last financial year the Tramways Committee paid the Electricity Committee £3,936 for energy.

Traction and Power Securities.—The revenue of the company, according to the report for the last year, amounted to £19,584. With the amount brought forward, the balance is thus £22,826. The directors propose to apply £3,000 to the depreciation of securities, and to transfer £15,000 to the investment reserve fund, carrying forward £4,826.

City of Carlisle Tramways Company.—The directors report that the revenue account shows a surplus of £1,785, a decrease of £118

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compared with the previous year, and after providing for debenture interest £633 remains, which the directors recommend shall be carried forward. The number of passengers carried was 2,551,331; and the total receipts amounted to £9,742.

Erdington Tramways.—Erdington Tramways Committee have issued the first report on the working of the tramways, the period covered being from the date of the inauguration, April 22, 1907, to January 31 last. The receipts amounted to £9,970, equal to 10·67d. per car mile, and the expenses were £8,562. The latter figure includes debt charges and £4,869 (equal to 5d. per car mile) paid to Birmingham Corporation to cover traffic expenses. The number of passengers was 2,090,481.

Mersey Railway Company.—The directors report for the half-year ended December 31 last shows that the total receipts from all sources were £51,027, against £47,359 in the corresponding half of 1906. The working expenses were £37,308, against 35,884. The credit balance is employed in payment of debenture interest and a few minor items. The number of passengers was 5,604,295, against 5,271,524, exclusive of season ticket holders. The train mileage was 416,189, against 416,555.

Metropolitan Electric Tramways, Limited.—The report of the directors for the year ended December 31 last states that the total revenue amounted to £297,223, including £27,476, the balance of dividends received in 1906 from the North Metropolitan Tramways Company. The traffic receipts which amounted to £244,200, show the satisfactory increase of £64,600 over the previous year, after deducting all expenses chargeable to revenue, including £10,500 for reconstruction and renewals, and writing down preliminary expenses.

Birmingham Cable Tramway.—Handsworth Tramways Committee reported, at the last meeting of the District Council, that the Board of Trade having on March 7 approved of the proposed service of notice under section 43 of the Tramways Act, 1870, requiring the City of Birmingham Tramways Company to sell to the Council so much of the cable tramway as is within the Urban district of Handsworth, the notice was served on the company on March 10. Negotiations as to the future working of the tramways in the district are proceeding.

End of the Accrington Company.—The annual meeting of the Accrington Steam Tramways Company was held on February 26. Mr. James Kenyon, the chairman, said that they had met for the last time as an operating company. In the sale of their undertaking to the local authority they had got the poorest award from the arbitrators for any undertaking of the kind. He moved the adoption of the report, which declared a dividend at the rate of 6 per cent. per annum. Business in connection with the winding-up of the company was conducted in private.

Lavish Distribution of Tramway Profits.—A reduction of 3½d. per £1 in the rates for the present half-year has been the result of a grant of £22,000 in aid of rates made by Sheffield Tramways Committee. It is pointed out by a local newspaper that since 1900 no less a sum than £125,694 has been applied from this source for the relief of the rates. From the profits on tramways also comes the cost of municipal music, provision of bands in the parks, concerts in public halls, etc.; £1,000 a year for five years for Sheffield University, and a yearly grant to the School of Modern Languages.

Anglo-Argentine Tramways Company.—The directors report that the balance to the credit of the revenue account on December 31, 1907, including £10,081 brought forward, and including the profits of the six months' working of the Buenos Ayres and Belgrano Electric Tramways system (after deduction of interest on the balance of unpaid purchase money), and allowing £65,000 for depreciation and renewal funds (in addition to amounts expended on ordinary maintenance), amounts to £335,323. After transferring £4,200 to a sinking fund for the redemption of the preference shares, and £4,000 to investment depreciation account, out of the balance available for dividend the directors recommend the payment of a final dividend on the 320,000 second preference shares of 5s. per share (less income tax), also a dividend on the 40,000 new ordinary shares at the rate of 8 per cent. per annum, carrying forward £16,734.

W. T. Henley's Telegraph Works Company.—At the annual meeting on March 6, Mr. Sydney Gedge, who presided, said that nothing eventful had happened in their business; the whole of it might be called "bread-and-butter" work, but it had been such as enabled them to pay 15 per cent. He thought the board were doing right in not dividing profits too closely, and in building up, as they were doing, a very considerable reserve fund. During the past few years the municipalities had been spending what some people thought too much money, and these heavy borrowings had damaged the credit of various corporate bodies. Thus there had been a check to municipal enterprise in the past twelve months owing to this cause and to the dearness of money. But there would be a renewed demand for tramways, and in districts not hitherto dreamed of, and with money so much cheaper, additional tramways would be electrified.

Glasgow District Subway Company.—The accounts of this company for the half-year ended January 31 last show that the traffic receipts amounted to £34,795 (equal to 12·75d. per train mile), as against £33,406 (12·33d. per train mile) in the corresponding half-year. The total receipts were £37,919 (13·89d. per train mile), against £36,776 (13·57d. per train mile). The expenditure, including £500 carried to the general reserve fund, was £20,851 (7·64d. per train mile), against £18,358 (6·77d. per train mile). The credit balance is thus £17,069, against £18,418. After paying interest, the balance available for dividend is £12,200, compared with £14,562. Out of this the directors recommend the full dividend at the rate of 4 per cent. per annum on the preference shares, and a dividend at the rate of ½ per cent. per annum on the ordinary shares, leaving a balance of £631 to be carried forward. The number of passengers for the half-year was 8,695,995, against 8,359,052, while the number of train miles run was 654,940, against 650,260.

Devonport and District Tramways Company.—At the half-yearly meeting of this company, held in London on March 11, the directors' report, which was submitted and adopted, showed an available balance, after paying all expenses, of £2,157. This was devoted to placing £1,000 to permanent way renewal fund and £1,000 to capital redemption fund, carrying forward the balance of £157. Mr. W. G. Bond, who presided, said that there was a decrease in receipts of £346, and an increase of expenses of £175. The latter feature was due to a rise in the expense for permanent way maintenance. The board had started a parcel service, which up to the present had not been a financial success, and a system of weekly tickets for workmen had to be withdrawn, as the response was so small. At the request of the Town Council they had introduced two halfpenny stages, with the result that they had lost rather more penny fares than they had gained halfpenny ones. The directors had recently addressed a letter to the Devonport Corporation asking for more favourable terms in regard to the lines leased by the company from the Corporation.

Lancashire United Tramways.—At the annual meeting of this company, held in London on February 28, Mr. J. M. Henderson, who presided, said the profit for the year amounted to £12,789, and, after payment of the debenture stock interest, there was a balance of £289. This amount, with the credit balance brought forward from last year, had been written off the loss on the sale of motor-omnibuses. The receipts from the various tramways (other than St. Helen's) comprised in the company's system were £69,349, and the working expenses £56,499. The receipts per mile were higher than had been attained in any previous year, and it was gratifying to know that they had been steadily increasing since operations began For the year ending June 30 the working of the new St. Helen's and District Tramways Company (in which this company had a preponderating holding) resulted in a profit, but it was not possible to distribute any of it in dividend owing to the adverse balance of previous years. Owing to its interurban character, their system had been particularly unfortunate owing to the wet weather of last summer, but since October last there had been a gain on the same mileage of nearly £400 per month over the corresponding period of last year. After exhaustive inquiry, the directors had introduced a comprehensive scheme over the system of short-distance return fares for workmen. The scheme had worked very well, the number carried in January this year being 295,693, against 174,825 for the same month last year.

Bruce Peebles and Company, Limited.—A meeting of the creditors of this company (in liquidation) was held in London on March 27. Mr. A. W. Tait, one of the liquidators, said that the balance of deficiency was £163,086. He proposed that a committee should be appointed to go into details. All the losses hinged on the fact that the company had been seriously in want of working capital for some time past. The year 1907 was a very difficult one for all manufacturing concerns, and for the electrical industry in particular. There had been an abnormal rise in raw materials, whilst the price of the finished article had steadily decreased. Difficulties were due to losses on contracts following upon the high price of raw materials, to insufficient reserves for contingencies, to losses due on the realisation of securities, to an insufficiency of working capital, and to the heavy expenses in connection with the administration of the business. If there were a forced realisation the assets, he calculated, would realise only about 6s 6d. in the pound, and even this could not be distributed amongst creditors for a considerable time, probably two years. If the business were reconstructed on a reasonable footing, reasonable profits should accrue to the concern. He presented the following scheme: That the debentures should be extended for ten years, that the interest should remain as at present, at 5 per cent., with a sinking fund of 2 per cent. per annum; that the trade creditors should accept 7s. 6d. in the pound in a debenture which would be redeemed by the proceeds of the sale of securities and the collection of contract balances, and this 7s. 6d., he considered, should be paid in a short time. Thu they would receive probably more in cash under the scheme than by a forced liquidation. The other 12s. 6d. would be given the creditors in the shape of a cumulative 6 per cent. preference share in the new undertaking. Altogether 120,000 cumulative preference shares would

(Continued on page 287.)

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track). Mls.	Line open (single track). Chs.	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Sinking Fund and Loans Repaid.	Depreciation, Renewal, and Reserve Funds.	Income. Traffic.	Income. Other.	Income. Total.
Aberdeen ...	May 31, 1907	Dec., 1899	E.	27	60	350,000	317,140	32,860	345,025	12,435	299,970	17,169	40,155	65,853	834	66,687
Ayr	May 15, 1907	Sept., 1901	,,	9	52	105,000	–70,000	35,000	79,934	8,283	62,752	4,820	14,954	14,672	541	15,213
Birmingham ...	Mar. 31, 1907	Jan., 1904	,,	...		1,079,687	743,037	336,650	850,916	...	732,016	11,021	25,932	132,662	3,762	136,424
Blackburn ..	Mar. 25, 1907	Mar., 1899	,,	23	64	400,337	328,087	72,250	330,563	13,469	236,042	81,647	...	52,811	2,141	54,952
Blackpool ...	Mar. 31, 1907	June, 1899	,,	17 * 3	30 69	424,490	281,390	143,100	281,390	16,195	281,390	54,624	13,236	50,554	952	51,506
Bolton	Mar. 31, 1907	Dec., 1899	,,	42	42	632,760	528,027	104,733	471,760	11,093	377,482	71,801	48,622	110,935	359	111,294
Bradford ...	Mar. 31, 1907	July, 1898	,,	87 * 9	67 6	1,192,626	902,878	289,748	903,368	9,321	756,992	200,046	38,024	227,495	4,612	232,107
Brighton	Mar. 31, 1907	Nov., 1901	,,	17	15	279,070	274,070	5,000	274,905	15,994	257,186	20,885	3,165	48,898	1,755	50,653
Burnley	Mar. 31, 1907	Dec., 1901	,,	14 * 5	20 32	278,892	252,896	25,996	185,325	13,005	175,331	23,012	20,793	62,076	728	62,804
Burton-on-Trent	Mar. 31, 1907	Aug., 1903	,,	9	70	100,073	88,336	11,737	92,971	9,415	83,746	...	...	15,102	430	15,532
Bury	Mar. 31, 1907	June, 1903	,,	17 * 9	50 21	407,800	225,525	182,275	242,466	13,757	223,500	8,246	5,904	50,518	131	50,649
Chester	Mar. 25, 1907	April, 1903	,,	6	35	92,991	73,991	19,000	77,662	12,064	70,221	5,141	332	10,274	329	10,603
Chesterfield ...	Mar 31, 1907	Dec., 1904	,,	5	68	95,000	68,528	26,472	68,529	11,714	65,000	2,557	...	10,989	503	11,492
Colchester ...	Mar. 31, 1907	July, 1904	,,	7	75	70,748	68,755	1,993	68,847	8,673	65,858	4,214	...	10,787	580	11,367
Croydon	Mar. 31, 1907	June, 1906	,,	19	44	336,611	254,010	82,601	270,043	13,813	224,234	35,276	...	61,091	975	62,066
Darlington ...	Mar. 31, 1907	June, 1904	,,	8	71	107,500	75,165	32,335	76,293	8,584	69,425	5,540	...	10,820	323	11,143
Darwen	Mar. 31, 1907	Oct., 1900	,,	7	13	93,400	85,400	8,000	85,436	11,928	73,879	13,658	1,150	13,327	681	14,008
Derby	Mar. 31, 1907	July, 1904	,,	E. 15 H.	1 	... ...	... ...	... ...	175,247 ...	... ...	159,722 ...	15,525 ...	... ...	E 37,558 H 4,184	871 147	38,429 4,331
Doncaster ...	Mar. 31, 1907	June, 1902	,,	10	42	92,500	84,200	8,300	84,735	8,051	79,300	5,727	...	12,030	337	12,367
Douglas (I.O.M.)	Mar. 31, 1907	...	H. C.	3 2	40 60	54,020	54,020	...	55,514	8,882	49,166	4,889	3,000	20,220	1,314	21,534
Dundee	May 15, 1907	July, 1900	E.	24	41	...	...	...	312,886	12,746	258,824	47,613	26,780	56,921	751	57,672
East Ham ...	Mar. 31, 1907	June, 1901	,,	12	61	160,442	160,133	309	164,064	12,855	146,323	20,775	3,442	46,435	653	47,088
Gloucester ...	Mar. 31, 1907	April, 1904	,,	12 * 2	41 39	151,000	126,000	25,000	127,326	10,186	123,333	3,993	...	14,192	841	15,033
Halifax	Mar. 31, 1907	June, 1898	,,	52	26	663,751	393,764	269,987	393,280	7,516	333,287	48,149	8,544	75,986	1,341	77,327
Ilford	Mar. 31, 1907	Mar., 1903	,,	11	28	142,603	142,396	207	142,396	12,546	129,549	13,054	6,532	24,478	912	25,390
Ipswich	Mar. 31, 1907	Nov., 1903	,,	14	70	116,471	110,000	6,471	114,334	7,687	106,098	4,674	...	21,262	780	22,042
Keighley	June 30, 1907	Oct., 1904	,,	6	9	50,934	46,004	4,930	46,004	7,526	39,891	6,827	1,641	8,019	222	8,241
Kilmarnock ...	May 15, 1907	Dec., 1904		5	42	65,000	54,615	10,385	54,078	9,788	54,615	151	...	8,246	357	8,603
Kirkcaldy ...	May 15 1907	Feb., 1903	,,	7	62	200,000	88,693	111,307	89,404	11,499	83,750	4,943	1,267	13,230	473	13,703
Lancaster ...	Mar. 25, 1907	Jan., 1903	,,	4	65	60,000	51,550	8,450	41,339	8,590	46,250	5,651	...	5,360	119	5,479
Leith	May 15, 1907	Aug., 1905	,,	11	76	225,000	171,345	53,655	174,796	15,046	179,062	6,873	...	26,380	643	27,033
Lincoln	Mar. 31, 1907	Nov., 1905	2	2	77	98,519	43,072	55,447	39,231	13,243	48,061	2,819	...	5,741	104	5,845
Liverpool ...	Dec. 31, 1906	Nov., 1898	E.	104	0	2,442,600	2,044,775	397,825	1,901,997	18,288	1,604,435	503,941	238,354	563,777	7,439	571,216
Lowestoft ...	Sep. 30, 1907	July, 1903	,,	5	79	129,230	79,231	49,999	79,231	13,233	75,135	5,076	...	10,937	349	11,286
Maidstone ...	Mar 31. 1907	July, 1904	,,	2	23	25,000	25,000	...	26,255	11,477	25,005	1,250	2,000	5,650	241	5,891
Manchester ...	Mar. 31, 1907	June, 1901	,,	111 *43 †14	6 57 54	1,875,015	1,558,669	316,346	1,725,845	15,538	1,436,184	144,197	320,028	712,976	6,697	719,673
Nelson	Mar. 31. 1907	Feb., 1903	,,	3	69	38,000	35,662	2,338	35,662	9,233	33,291	2,371	...	7,264	55	7,319
Newport (Mon.)...	Mar. 31, 1907	April, 1903	,,	14	40	264,500	189,819	74,681	199,424	13,753	180,461	18,003	1,046	32,547	652	33,199
Nottingham ...	Mar. 31, 1907	Jan., 1901	,,	35	58	730,300	581,734	148,566	581,734	16,284	473,128	116,340	53,668	137,998	1,995	139,993
Oldham	Mar. 25, 1907	May, 1902	,,	27 * 8	20 31	507,769	439,547	68,222	440,422	16,162	380,354	94,643	6,119	92,763	1,315	94,078
Perth	May 15, 1907	Nov., 1905	,,	8	40	70,000	73,400	...	74,879	8,809	70,450	3,710	...	7,985	411	8,396
Plymouth ...	Mar. 31, 1907	Sept., 1899	,,	15	0	182,856	174,906	7,950	215,986	14,399	132,872	45,355	23,126	31,256	10	31,266
Rochdale	Mar. 31, 1907	May, 1902	,,	24 * 5	45 26	354,491	345,000	9,491	343,246	13,974	345,000	16,231	...	53,830	308	54,138
Rotherham ...	Mar. 31, 1907	Jan., 1903	,,	10	0	228,550	112,500	116,050	123,914	12,391	104,040	8,517	9,181	26,917	819	27,736
Salford	Mar. 31, 1907	Oct., 1901	,,	36 *38	40 20	1,192,246	669,583	522,663	574,853	15,749	626,609	125,701	46,146	232,551	...	232,551
Southampton ...	Mar. 31, 1907	Jan., 1900	,,	16	22	202,539	172,397	30,142	200,183	12,300	164,242	35,659	690	49,636	1,368	51,004
Southport ..	Mar. 31, 1907	July, 1900	,,	10 * 8	61 78	292,000	196,500	95,500	195,412	9,930	157,230	39,270	6,773	18,176	307	18,483
South Shields ...	Mar. 31, 1907	Mar., 1906	,,	10	21	252,171	134,061	118,110	155,422	15,145	133,360	7,653	2,531	23,992	46	24,038
Stalyb'ge, Hyde, Mossley, & D'k'f'd	Mar 31, 1907	May, 1904	,,	27	57	325,270	259,470	65,800	258,177	9,318	244,028	15,442	...	38,766	39	38,805
Sunderland ...	Mar. 31, 1907	Aug., 1900	,,	19	40	304,086	294,461	9,625	289,691	14,825	233,485	52,094	...	72,054	342	72,396
Wallasey ...	Mar. 31, 1907	Mar., 1902	,,	12	55	140,436	138,150	2,286	138,917	10,950	127,918	10,723	18,592	42,254	630	42,884
Walsall	Dec. 31, 1906	Dec., 1902	,,	15 * 2	2 5	188,144	151,000	37,144	142,947	8,366	145,900	6,162	...	26,400	546	26,946
Warrington ...	Mar. 31, 1907	April, 1902	,,	9	52	128,050	100,446	27,604	101,615	10,530	89,721	10,831	1,530	19,204	336	19,540
West Ham ...	Mar. 31, 1907	Feb., 1904	,,	26	35	509,119	353,753	155,366	547,989	20,728	531,494	11,822	19,548	116,793	2,982	119,775
Wigan	Mar. 31, 1907	April, 1901	,,	24	70	461,570	459,670	1,900	515,212	20,712	465,985	55,168	...	61,101	1,368	62,469
Wolverhampton	Mar. 31, 1907	April, 1902	2	20 * 4	0 40	279,228	245,861	33,367	254,606	12,730	227,359	17,260 Motor Omnibuses	18,051	43,183 2,375	640 45	43,823 2,420
Yarmouth (Gt.)...	Mar. 31, 1907	June, 1902	E.	12	4	144,500	110,000	34,500	110,363	9,159	101,791	5,424	1,197	21,390	512	21,902

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast	Mar. 31, 1907	Nov., 1905	E.	73	18	1,225,448	1,060,000	165,448	1,115,784	15,232	1,060,000	22,256	13,000	177,832	3,307	181,139
Bexley	Mar. 31, 1907	Oct., 1903	,,	6	73	98,259	96,984	1,275	94,858	13,723	90,854	6,130	...	11,419	1,569	12,988
Birkenhead	Mar. 31, 1907	Feb., 1901	,,	23	79	366,266	357,854	8,412	357,991	14,914	306,891	50,964	11,025	54,252	1,156	55,408
Bournemouth ...	Mar. 31, 1907	July, 1902	,,	34 *10	35 0	381,554	381,554	...	401,668	11,664	368,221	35,518	24,999	83,663	360	84,023
Cardiff	Mar. 31, 1907	May. 1902	,,	36	50	802,039	732,383	69,656	767,109	20,948	683,467	73,808	9,277	106,551	12,564	119,115
Glasgow	May 31, 1907	Oct., 1898	,,	165 * 10	47 55	3,100,000	2,227,353	872,647	3,104,061	18,746	1,679,974	547,379	1,122,104	887,381	8,461	895,842
Huddersfield ...	Mar. 31, 1907	Feb., 1901	,,	33 * 3	0 20	646,284	398,957	247,327	412,902	12,512	325,819	82,507	44,360	78,115	3,081	81,196
Hull	Mar. 31, 1907	July, 1899	,,	27	15	488,673	436,543	52,130	436,543	16,057	436,543	67,357	74,775	121,186	...	121,186
Leeds	Mar. 31, 1907	Aug., 1897	,,	96	50	1,340,374	1,340,374	...	1,303,815	13,494	1,167,263	213,248	33,270	323,913	3,891	327,794
Leicester... ...	Dec. 31, 1906	May, 1904	,,	37	0	734,838	678,805	56,033	677,829	18,320	651,645	46,672	41,448	114,752	1,776	116,528
London	Mar. 31, 1907	May, 1903	1	H100 E116	6 55	*	*	*	... 6,736,737	... 31,077	... 6,133,564	... 603,173	... 141,855	567,694 810,320	15,296 14,676	582,990 824,996
N'castle-on-Tyne	Mar. 31, 1907	Dec., 1901	E.	53 *6	0 10	1,413,989	1,164,028	249,961	1,150,701	21,711	1,029,992	152,476	43,515	205,262	3,392	208,654
Northampton ...	Mar. 31, 1907	July, 1904	,, H.	9 ...	6 	128,300 ...	127,255 ...	1,045 ...	127,374 ...	14,036 ...	115,546 ...	11,709 ...	2,113 ...	21,542 770	542 88	22,084 858
Portsmouth ..	Mar. 31, 1907	Sep., 1901	E.	28	40	672,272	661,714	10,558	670,157	23,514	618,341	100,715	48,695	98,911	3,103	102,014
Preston	Mar. 31, 1907	June, 1904	,,	17	16	224,102	187,269	36,832	187,269	10,888	167,775	14,487	9,907	37,796	150	37,946
Reading	Mar. 31, 1907	July, 1903	,,	13	15	231,658	231,658	...	220,783	16,742	204,993	22,548	7,466	32,661	972	33,633
Sheffield	Mar. 25, 1907	Sep., 1899	,,	56	28	1,163,646	1,133,770	29,876	1,172,279	17,683	970,620	136,278	74,245	276,907	2,679	279,586

E—Electric trolley system. H—Horse lines. C—Cable lines. * Indicates lines leased. † Lines on which running powers are exercised.

1 Horse, conduit, and electric. 2 Surface contact.

* Conferred by Annual Money Act, which limits amount for each financial year. Powers not exercised are lapsed.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name	Operating Expenses.					Net Income.	Additions to Net Income.	Deductions from Net Income.						Net Surplus + or Deficit −
	Traffic.	General.	Repairs & Maintenance.	Power.	Total.			Interest.	Sinking Fund.	Income Tax.	Depreciation & Renewal	Sundries.	Total.	
Aberdeen	16,734	6,548	6,008	9,361	38,651	28,036	4,134	10,985	3,515	...	16,737	933	32,170	...
Ayr	3,295	1,813	1,150	2,005	8,263	6,950	70	2,400	958	303	2,367	...	6,028	+ 992
Birmingham	27,311	9,298	6,028	25,602	68,239	68,185	...	18,447	6,547	...	14,660	16,531	56,185	+ 12,000
Blackburn	11,779	3,016	7,373	11,018	33,186	21,766	...	7,583	12,878	448	...	345	21,254	+ 512
Blackpool	10,648	3,646	6,199	9,399	29,892	21,614	3,480	8,590	6,349	113	6,042	...	21,094	+ 4,000
Bolton	25,322	6,443	13,209	16,589	61,563	49,731	753	12,993	13,573	..	14,693	146	41,405	+ 9,079
Bradford	62,245	19,909	31,785	45,644	159,583	72,524	3,232	25,020	29,484	2,543	4,536	4,173	65,756	+ 10,000
Brighton	13,047	3,652	6,558	11,243	34,500	16,153	...	8,579	5,164	...	...	...	13,743	+ 2,410
Burnley	14,251	4,833	6,971	15,237	41,292	21,512	...	5,855	4,834	...	8,766	2,057	21,512	...
Burton-on-Trent	4,738	1,634	1,721	2,845	10,938	4,594	418	2,004	1,978	...	1,000	907	5,889	− 877
Bury	11,719	3,877	4,018	8,471	28,085	22,564	244	7,658	5,253	385	2,500	6,002	21,798	− 1,715
Chester	2,752	1,309	506	1,946	6,513	4,090	...	2,436	1,287	..	367	...	4,690	...
Chesterfield	2,691	635	769	1,882	5,977	5,515	...	4,060		133	...	...	4,193	+ 1,322
Colchester	3,669	1,285	1,169	3,117	9,240	2,127	...	2,485	1,732	...	...	...	4,217	− 2,090
Croydon	17,515	4,862	6,798	12,597	41,772	20,294	401	6,238	4,804	600	9,053	...	20,695	...
Darlington	3,551	671	881	2,235	7,338	3,805	35	2,437	1,941	...	..	...	4,398	− 558
Darwen	3,208	731	1,900	2,780	8,619	5,389	...	2,407	2,048	...	1,050	...	5,505	− 116
Derby	E 11,179 H 1,497	2,043 163	2,055 337	7,111 2,929	22,388 4,926	16,041 ...	548	5,657	2,387	...	...	615	8,659	+ 7,930
Doncaster	3,509	994	1,634	3,597	9,734	2,633	...	2,651	1,249	95	...	...	3,995	− 1,362
Douglas (I.O.M.)	4,019	1,756	2,546	5,322	13,643	7,891	...	1,959	885	...	2,000	2,650	7,494	+ 397
Dundee	14,020	3,748	6,138	11,498	35,404	22,268	...	8,236	5,330	300	8,316	...	22,182	+ 86
East Ham	12,901	3,039	6,185	6,847	28,972	18,116	583	5,632	5,054	248	...	2,599	13,533	− 104
Gloucester	5,472	1,402	1,527	2,654	11,055	3,978	...	5,363	2,259	...	...	836	8,458	− 4,480
Halifax	19,530	7,616	11,776	18,960	57,882	19,445	1,180	12,782	8,588	457	...	475	22,302	− 1,677
Ilford	8,206	2,430	2,207	4,286	17,129	8,261	1,666	4,804	3,949	...	792	382	9,927	...
Ipswich	7,645	1,732	2,249	4,501	16,127	5,915	...	4,157	1,753	...	...	...	5,910	+ 5
Keighley	2,523	548	465	1,656	5,192	3,048	90	1,331	1,554	...	253	...	3,138	...
Kilmarnock	2,990	747	638	1,925	6,300	2,303	...	1,886	151	19	...	652	2,708	− 405
Kirkcaldy	4,330	822	720	3,212	9,084	4,619	...	2,916	2,103	...	409	184	5,612	− 993
Lancaster	2,264	863	673	1,823	5,623	...	90	1,554	1,229	...	...	* 144	...	− 2,837
Leith	8,883	2,482	2,368	4,153	17,886	9,137	62	5,906	6,873	...	...	150	12,929	− 3,729
Lincoln	1,436	844	522	1,027	3,829	2,016	...	1,150	1,368	...	...	...	2,518	− 502
Liverpool	148,668	54,452	82,367	99,918	385,405	185,811	12,403	53,244	56,337	...	55,171	5,877	170,629	+ 27,585
Lowestoft	3,658	859	1,418	3,180	9,115	2,171	.	2,607	1,332	...	...	...	3,939	− 1,768
Maidstone	1,352	656	514	1,509	4,031	1,860	122	983	625	...	...	...	1,608	+ 374
Manchester	196,785	63,374	63,270	131,264	454,693	264,980	1,911	50,141	39,594	4,769	87,827	29,560	211,891	+ 55,000
Nelson	2,111	383	868	2,105	5,467	1,852	...	1,072	765	76	...	...	1,913	− 61
Newport (Mon.)	7,423	3,039	4,927	6,488	21,877	11,322	2,184	7,838	4,140	99	45	...	12,122	+ 1,384
Nottingham	33,457	12,553	12,563	22,483	81,056	58,937	...	15,889	16,493	...	...	2,811	35,193	+ 23,744
Oldham	20,089	4,317	8,148	21,582	54,136	39,942	1,110	12,436	13,227	277	..	6,447	32,387	+ 8,665
Perth	2,505	677	140	1,741	5,063	3,333	47	2,634	1,892	2	...	...	4,528	− 1,148
Plymouth	6,811	2,728	5,153	7,170	21,862	9,404	1,225	4,624	4,727	...	...	1,278	10,629	...
Rochdale	13,656	2,323	4,361	9,165	29,505	24,633	...	10,448	6,907	772	...	3,613	21,740	+ 2,893
Rotherham	7,566	2,215	2,171	6,899	18,851	8,885	1,463	3,737	2,260	...	4,201	150	10,348	...
Salford	61,281	14,543	21,165	45,177	142,166	90,385	4,439	20,452	18,691	1,446	14,889	26,346	81,824	+ 13,000
Southampton	14,032	4,495	7,024	11,019	36,570	14,434	...	6,222	5,192	212	2,535	273	14,434	...
Southport	4,508	1,648	1,832	3,238	11,226	7,257	6,325	6,434	4,946	...	1,977	150	13,507	+ 75
South Shields	5,038	1,852	988	4,260	12,138	11,900	111	4,504	2,859	...	2,531	2,117	12,011	...
Stalybridge, Hyde, Mossley, & D'kinf'd	14,906	3,737	4,117	9,180	31,940	6,865	...	8,949	6,115	...	...	...	15,064	− 8,199
Sunderland	18,417	5,406	4,159	12,840	40,822	31,574	704	8,751	9,014	469	6,259	661	25,154	+ 7,124
Wallasey	11,716	3,190	3,346	8,914	27,166	15,718	221	4,873	2,634	...	3,000	553	11,060	+ 4,879
Walsall	6,849	2,418	2,862	3,965	16,094	10,852	1,053	5,099	2,148	269	4,389	...	...	...
Warrington	4,996	1,460	2,178	3,813	12,447	7,093	127	3,195	2,715	...	...	...	5,910	+ 1,310
West Ham	39,667	7,858	9,084	15,810	72,419	47,356	162	14,902	7,444	650	7,722	2,810	33,528	+ 13,990
Wigan	15,416	8,038	10,560	14,807	48,821	13,648	...	18,450	10,260	...	...	1,330	30,040	− 16,392
Wolverhampton	780 10,014	116 3,313	858 3,793	409 7,417	2,154 24,537	266 19,286	... 719	... 7,808	... 4,130	... ...	... 5,783	... 359	... 18,080	... + 2,191
Yarmouth (Gt.)	6,547	1,859	1,922	3,942	14,270	7,632	...	3,376	1,962	...	...	...	5,338	+ 2,294

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast	54,732	12,296	20,277	15,953	103,258	77,881	111	34,339	21,175	...	13,000	...	68,514	+ 9,478
Bexley	3,229	1,314	1,645	2,658	8,846	4,142	127	3,132	1,810	...	...	...	4,942	− 673
Birkenhead	15,049	5,092	7,506	5,858	33,505	21,903	...	11,891	9,289	200	317	206	21,903	...
Bournemouth	22,562	6,175	10,134	14,570	53,441	30,582	1,874	12,185	12,756	...	...	6,664	31,425	+ 1,031
Cardiff	36,893	9,384	11,802	7,094	65,174	49,185	...	23,138	19,729	...	...	1,913	44,780	+ 4,405
Glasgow	245,021	86,791	122,126	31,318	485,256	410,586	3,510	63,769	49,777	9,932	168,408	51,931	343,817	+ 70,279
Huddersfield	18,959	3,931	12,086	5,065	40,041	41,155	303	12,185	9,808	806	12,427	1,206	36,432	+ 5,026
Hull	30,592	8,933	21,301	9,352	70,178	51,008	818	12,942	9,528	1,224	10,604	...	34,298	+ 17,528
Leeds	87,112	29,403	37,440	17,255	171,210	156,584	9,512	43,005	38,029	3,946	11,481	373	96,834	+ 69,262
Leicester	41,903	8,823	10,057	8,157	68,940	47,588	551	22,761	11,872	396	13,110	...	48,139	...
London	H 202,483 E 213,906	69,981 88,654	52,221 84,065	259,683 81,478	584,368 468,103	... 356,893	... 4,424	174,778	153,155	1,425	35,000	22,285	386,643	− 25,326
N'castle-on-Tyne	56,004	16,536	20,482	13,060	106,882	102,572	3,071	34,323	34,255	4,366	335	3,924	75,959	+ 28,440
Northampton	E 5,763 H ...	1,894 ...	1,339 ...	2,290 ...	11,286 1,245	10,798 ...	110 ...	... 4,353	... 3,728	... ...	... 1,355	... 472	... 9,908	... + 1,000
Portsmouth	26,501	7,660	6,029	5,565	45,755	56,259	353	19,697	16,217	1,109	6,261	4,303	47,587	+ 9,025
Preston	10,071	4,505	4,004	2,203	20,783	17,163	...	5,822	5,773	...	5,568	...	17,163	...
Reading	8,515	3,725	2,618	3,405	18,263	15,370	...	6,558	5,607	145	3,060	...	15,370	...
Sheffield	97,590	20,245	29,662	20,922	168,419	111,167	812	41,393	25,716	2,203	20,000	2,000	91,312	+ 20,667

H—Horse lines. E—Electric trolley lines. * Deficit on Revenue Account.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Appropriation of Net Surplus. Carried Forward.	Reserve.	Relief of Rates.	Population Served.	Car Mileage.	Passengers Carried.	Passengers Carried per Car Mile.	Average Fare per Passenger. d.	Average Journeys per Head of Populat'n per Annum.	Average Car Miles per Day per Car.	Average Total Revenue per Car Mile. d.	Average Traffic Revenue per Car Mile. d.	Traffic Revenue per Mile of Single Track.	Average Traffic Revenue per Annum per Head of Populat'n Served.	Operating Expenses per Passenger. d.	Percentage of Operating Expenses to Total Revenue. %
Aberdeen	..	...	...	167,000	1,529,682	17,676,008	11·55	·95	105·84	35	11·112	10·332	2,522	8/4	·52	54·57
Ayr	..	992	...	33,000	378,884	3,603,789	9·51	·98	109·20	104	9·637	9·294	1,520	8/11	·55	54·31
Birmingham	12,000															
Blackburn	512	...	...	200,000	1,002,372	10,094,028	10·07	1·25	50	105	13·15	12·64	2,219	5/3	·80	51·01
Blackpool	...	...	4,000	...	958,836	8,304,218	8·66	1·58	...	109	12·89	12·65	2,380	...	·864	58·04
Bolton	...	...	9,079	221,000	2,411,969	23,410,690	9·70	1·14	105·93	111·21	11·07	11·03	2,650	10/5	·63	55·40
Bradford	...	...	10,000	324,000	5,167,261	46,728,977	9·043	1·17	144	104·09	10·78	10·566	2,347	11/5	·819	68·16
Brighton	2,410	...	...	128,095	1,118,590	10,759,310	9·62	1·09	84	87·68	10·86	10·49	2,844	7/8	·77	68·11
Burnley	...	...		165,000	1,205,830	11,967,498	9·92	1·31	73	100	12·50	12·35	3,159	7/6	·83	65·86
Burton-on-Trent		...	...	52,000	421,317	3,383,527	8·03	1·072	65	58	8·85	8·60	1,529	5/10	·78	70·42
Bury	...	...	2,725	124,726	1,276,227	9,944,897	8	1·22	79·73	123·33	9·525	9·500	1,854	8/1	·677	55·45
Chester	...	...	...	38,303	291,555	2,532,778	8·687	·97	66·12	92	8·731	8·460	2,854	5/4	·62	63
Chesterfield	922	...	400	38,000	275,417	2,302,037	8·36	1·13	60	125	10·01	9·58	1,900	5/9	·62	53
Colchester	...	...	...	40,540	353,331	2,514,589	7·11	1·02	62·02	86	7·721	7·327	1,522	5/4	·88	81·5
Croydon	...	...	...	154,342	1,502,408	13,514,918	8·99	1·08	87·56	103	9·915	9·76	3,125	7/11	·742	66·87
Darlington	...	...	...	50,000	372,912	3,169,036	8·5	·82	63·38	92·9	7·171	6·964	1,217	4/4	·5	65·85
Darwen	...	...	...	41,864	240,893	2,562,234	10·63	1·2	61	71·09	13·956	13·277	1,861	6/4	·807	61·63
Derby	7,930	...	...	124,000	E. 849,248	8,381,460	9·869	1·075	75·70	...	10·86	10·614	...	6/9	·64	58·26
					H. 109,023	1,004,914	9·222	·999			9·529	9·205			1·17	113·71
Doncaster	...	...	...	41,500	495,404	2,753,506	5·55	1·05	66·35	122	5·991	5·828	1,143	5/9	·85	78·71
Douglas (I.O.M.)	397	...	...	...	H. 286,513	2,161,667	7·017	1·696	...	70 Sum.	12·672	11·899	3,235	...	1·144	63·36
					C. 121,333	700,227				79 ..						
Dundee	..	86	...	164,500	1,162,792	15,554,905	13·3	·878	93	81	11·903	11·748	2,323	6/11	·546	61·38
East Ham	...	...	5,270	125,000	1,062,151	15,049,240	14·1	·74	120	108	10·64	10·492	3,638	7/5	·50	61·53
Gloucester	...	...	...	50,715	519,996	3,182,111	6	1·06	62·75	94·93	6·938	6·85	948	5/7	·83	73
Halifax	...	...	...	178,000	1,624,275	18,899,242	11·62	·97	106	78	11·425	11·228	1,474	8/6	·735	74·85
Ilford	...	...	...	70,000	645,117	6,586,754	10·2	·89	94	126	9·446	9·106	2,156	7/-	·624	67·46
Ipswich	5	...	...	73,000	654,253	5,289,006	8·08	·965	75·56	70·65	8·086	7·8	1,429	5/10	·73	73·16
Keighley	...	...	...	42,000	256,715	1,935,098	7·50	·994	46·07	100·41	7·704	7·497	1,312	3/10	·644	62
Kilmarnock	...	...	...	36,000	328,829	2,331,277	7·09	·84	64·76	98·80	6·279	6·018	1,492	4/7	·654	73·75
Kirkcaldy	..	...	...	34,063	466,919	4,640,618	9·939	·692	136·2	53	7·556	7·289	1,734	7/9	·47	66·29
Lancaster	...	...	...	44,600	194,577	1,353,681	6·96	·950	30·35	92	6·759	6·611	1,117	2/5	·997	108
Leith	...	...	...	113,251	861,162	8,519,563	9·9	·74	75·23	112	7·531	7·352	2,208	4/8	·504	66·22
Lincoln	...	...	...	52,500	137,186	1,437,946	10·48	·95	27·39	55	10·226	10·044	1,938	2/2	·64	65·50
Liverpool	...	..	27,585	770,000	12,115,934	122,094,528	10·07	1·108	158·56	106	11·315	11·168	5,421	14/8	·766	67
Lowestoft	...	...	...	31,000	343,190	2,622,922	7·64	1·00	84·61	67	7·83	7·65	1,827	7/-	·83	87·64
Maidstone	374	...	...	13,000	157,060	1,186,566	8·85	1·14	91·27	92·5	9·002	8·633	710	8/8	·81	68·44
Manchester	...	...	55,000	800,000	15,523,459	143,264,501	9·23	1·19	179	100	11·12	11·02	4,556	17/10	·76	63·18
Nelson	...	...	...	42,000	203,203	2,035,300	10·01	·86	48·46	93	8·645	8·580	1,881	3/5	·645	74·70
Newport (Mon.)	1,384	...	...	75,000	772,753	7,760,404	10·04	1·007	100·81	100	10·311	10·108	2,245	8/8·15	·677	65·90
Nottingham	...	6,744	17,000	254,568	2,731,552	31,218,691	11·43	1·06	123	95·50	12·30	12·13	3,863	10/10	·62	58
Oldham	...	3,665	5,000	160,000	1,818,444	18,647,731	10·25	1·19	116·55	104	12·416	12·243	2,604	11/7	·697	57·54
Perth	...	...	...	34,000	229,551	1,681,188	7·32	1·14	49·45	91	8·779	8·349	939	4/8	·723	60·3
Plymouth	..	...	...	118,000	721,115	7,324,347	10·157	1·024	62·07	90	10·406	10·403	2,084	5/4	·72	69·92
Rochdale	2,893	..	...	102,614	1,201,364	9,749,202	8·11	1·32	95	105	10·814	10·753	1,804	10/6	·73	55
Rotherham	...	...	...	61,500	618,211	5,743,298	9·29	1·125	93·39	109·56	10·767	10·450	2,692	8/9	·788	67·97
Salford	...	...	13,000	350,000	5,268,933	43,614,123	8·27	1·27	124·6	115·5	10·594	10·594	3,102	13/3	·782	59·99
Southampton	...	...	...	117,300	1,143,065	9,437,396	8·256	1·251	80	70	10·709	10·421	3,050	8/6	·93	71·70
Southport	75	...	...	31,312	447,821	4,068,131	9·08	1·07	129·9	102·5	9·905	9·741	1,691	11/7	·66	60
South Shields	..	...	...	112,000	559,948	5,654,929	10·09	1·01	50·48	99	10·30	10·28	2,337	4/3	·515	50·59
Stalybridge, &c.	...	...	...	92,811	1,422,122	9,780,464	6·877	·951	101·88	95·03	6·548	6·542	1,399	8/4	·784	82·3
Sunderland	...	...	7,124	170,000	1,535,425	17,483,132	11·38	1·006	102	76·8	11·314	11·261	3,687	8/6	·56	55·66
Wallasey	1,539	...	3,340	65,000	862,123	7,935,451	9·27	1·27	123	81·4	11·94	11·76	3,330	13/-	·816	62·60
Walsall	...		...	100,000	611,687	4,814,657	7·592	1·316	48	102	10·572	10·358	1,955	5/3	·82	59·727
Warrington	...	1,310	...	83,000	429,786	4,965,296	11·55	·93	59·82	103·42	10·911	10·724	1,989	4/7	·60	63·7
West Ham	4,322	.	9,668	308,284	2,556,854	35,502,836	13·88	·789	115	87	11·243	10·963	5,159	7/7	·492	60·00
Wigan	...	...	...	61,000	1,452,458	11,269,947	7·76	1·26	185	83	10·32	10·09	2,456	20/-	1·04	78
Wolverhampton	2,191		...	100,900	966,133	9,276,023	9·601	1·179	91·93	90	10·886	10·727	1,763	9/-	·691	57·72
Yarmouth (Gt.)	2,294	...	...	35,000	601,535	4,296,953	7·143	1·199	122·77	73·97	8·737	8·534	1,775	12/3	·798	65·15

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast	516	..	8,962	349,180	5,296,895	42,945,849	8·11	·99	123	128	8·21	8·06	2,473	10/4	·58	57
Bexley	...	...	...	16,300	268,619	1,737,204	6·46	1·70	106·58	...	11·604	10·202	1,652	14 -	1·22	68·11
Birkenhead	...	...	...	117,000	1,324,743	11,696,691	8·82	1·113	100·83	83·32	10·038	9·829	2,261	9/3	·687	60·84
Bournemouth	1,031	...	...	100,000	1,765,098	13,503,610	7·65	1·48	135	92	11·42	11·37	2,860	16/9	·95	63·65
Cardiff	4,405	...	...	164,333	2,624,504	24,438,164	9·31	1·046	148·71	99	10·893	9·744	2,910	12/11	·653	55·83
Glasgow	...	25,279	45,000 *	1,050,000	20,350,367	224,063,098	11·01	·95	213	101·20	10·565	10·465	5,035	16/11	·52	53·96
Huddersfield	5,026	...	...	120,000	1,794,691	15,252,150	8·50	1·22	127	112	10·79	10·38	2,770	13/-	·63	49·32
Hull	15,000	...	2,528	266,762	2,956,408	29,151,543	9·86	1·00	109	113·68	9·84	9·84	4,456	9 1	·58	57·89
Leeds	...	...	69,262	463,495	7,454,321	73,024,853	9·92	1·065	157·55	111·38	10·69	10·56	3,352	14/-	·563	52·23
Leicester	...	...	...	232,111	3,331,998	27,467,984	8·243	1·002	118	99	8·393	8·265	3,101	9/11	·60	59
London	...	...	...	...	H 13,862,718	131,165,027	9·46	1·04	...	82	10·093	9·828	5,762	...	1·069	100·24
					E 16,267,579	183,062,063	11·25	1·06	.	106	12·171	11·955	6,944	...	·614	56·74
N'castle-on-Tyne	...	14,856	13,584	300,000	4,263,174	45,506,468	10·67	1·11	152	106	11·75	11·56	3,871	13/8	·57	50·84
Northampton	...	...	1,000	90,000	E. 541,715	5,216,883	9·63	·99	60	90	E. 9·78	9·53	2,459	4/11	·519	E. 51·10
	...	...	...	...	H. 31,864	184,072	7·77	1·00	..	...	H. 6·46	5·80	...	...	1·624	H. 145·27
Portsmouth	4,025	...	5,000	202,000	2,199,823	20,668,825	9·40	1·15	102·32	83	11·129	10·791	3,471	9·9	·531	44·85
Preston	...	...	...	120,000	904,582	8,459,742	9·35	1·072	70·5	132·92	10·068	10·028	2,197	6·3	·59	54·77
Reading	...	...	..	80,000	918,825	8,130,179	8·84	·96	110	112	8·78	8·53	2,476	7 10	·53	54
Sheffield	...	...	20,667	447,951	6,804,656	73,966,299	10·870	·898	165	104·6	9·861	9·767	4,174	12 4	·546	60·24

* Applied as special depreciation. H—Horse lines. E—Electric trolley system.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Average Operating Expenses per Car Mile (excludi'g Power Cost). d.	Average Operating Expenses per Car Mile (including Power Cost). d.	Average Number of Cars in Use Daily.	Number of Cars in Stock.	Average Speed per Hour. Miles.	Average Car Hours per Day.	Average Distance of 1d. Fare. Miles.	Average Fare Charged per Mile. d.	Operating Expenses per Car Mile. Traffic. d.	General. d.	Repairs and Mainten-ance. d.	Power. d.	Total. d.	Board of Trade Units.	Cost per Board of Trade Unit. d.	Board of Trade Units used per car mile.
Aberdeen	4·595	6·064	44	69	7	704	1·31	·81	2·625	1·027	·943	1·469	6·064	1,906,218	1·17	1·25
Ayr	3·964	5·234	10	19	8	130	1·25	·75	2·087	1·148	·729	1·270	5·234	375,436	1·28	·99
Birmingham ...	—															
Blackburn	5·38	8·02	26	48	7·50	364	1·25	·76	2·82	·72	1·76	2·64	7·94	1,853,272	1·43	1·24
Blackpool	5·13	7·48	24	61	6	400	...	...	2·67	·91	1·55	2·35	7·48	1,261,946	1·79	1·31
Bolton	4·47	6·12	58	96	7½	932	1·40	·70	2·518	·639	1·313	1·656	6·126	3,619,390	1·10	1·50
Bradford	5·292	7·412	136	239	7·20	2,040	1·59	·501	2·891	·925	1·476	2·120	7·412	9,582,871	1·14	1·8
Brighton	4·99	7·40	32	50	6½	512	1·31	·72	2·799	·784	1·407	2·412	7·402	1,798,905	1·50	1·61
Burnley	5·18	8·218	27	46	7	405	1·25	·83	2·836	·963	1·387	3·032	8·218	2,525,135	1·45	2·08
Burton-on-Trent...	4·61	6·23	9·79	20	6¾	181	1·35	·70	2·70	·93	·98	1·62	6·23	551,758	1·385	1·16
Bury	3·689	5·282	...	47	7·56	...	1·22	·83	2·204	·729	·756	1·593	5·282	2,042,840	·99	1·6
Chester ...	3·762	5·364	6·4	13	8	115	1·27	·79	2·265	1·078	·419	1·602	5·364	266,856	1·75	·91
Chesterfield ...	3·56	5·20	6	12	7·15	108	1·38	·75	2·344	·554	·670	1·641	5·209	361,421	1·25	1·31
Colchester	4·159	6·276	10·68	18	6·12	171	1·13	·97	2·492	·873	·794	2·117	6·276	498,758	1·50	1·41
Croydon	4·661	6·673	48	60	6·85	725	2·15	·52	2·798	·777	1·086	2·012	6·673	1,511,590	2·00	1·006
Darlington... ...	3·284	4·723	11	16	6½	151	1·096	·82	2·285	·432	·567	1·439	4·723	429,105	1·25	1·15
Darwen	5·817	8·587	6	17	8·75	108	1·05	·81	3·196	·728	1·893	2·770	8·587	395,096	1·75	1·64
Derby	E. 4·318	6·327	...	39	...	...	...	...	3·16	·577	·581	2·009	6·327	1,137,705	1·50	1·34
	H. ...	10·837	...	5	..	...	...	...	3·294	·358	·741	6·444	10·837			
Doncaster	2·974	4·716	13	25	7·5	222	1·25	·8	1·7	·482	·792	1·742	4·716	575,470	1·50	1·16
Douglas (I.O.M.) ...	4·897	8·029	H 24 Sum.	43	6	...	1·5	1·23 S m.	2·365	1·033	1·499	3·132	8·029			
			C 9 ,,	14			1·37	1·45 ,,								
Dundee	4·934	7·307	42	60	6·2	528	1·468	·726	2·893	·774	1·267	2·373	7·307	2,207,559	1·25	1·8
East Ham	4·999	6·546	25	40	7	448	1·57	·64	2·915	·687	1·397	1·547	6·546	1,095,511	1·5	1·03
Gloucester	3·87	5·10	15	30	6·78	217	1·50	·62	2·526	·646	·705	1·225	5·102	637,491	1·00	1·21
Halifax	5·791	8·552	57	96	7·2	912	1·30	·77	2·886	1·125	1·740	2·801	8·552	3,033,499	1·50	1·87
Ilford	4·778	6·372	14	22	7·5	241	1·373	·74	3·053	·904	·821	1·594	6·372	897,916	1·146	1·302
Ipswich	4·265	5·916	19	36	6·30	216	1·53	·693	2·805	·635	·825	1·651	5·916	720,246	1·50	1·101
Keighley	3·306	4·854	7	12	7·61	126	2·35	·994	2·359	·513	·434	1·548	4·854	227,137	1·75	·88
Kilmarnock ...	3·193	4·598	9·11	14	7·43	121	1	·97	2·182	·545	·466	1·405	4·598	369,551	1·25	1·12
Kirkcaldy	3·305	4·956	18	22	6½	184	1·50	·64	2·437	·462	·406	1·651	4·956	685,269	1·125	1·467
Lancaster	4·687	6·936	6	12	8	96	1·019	·959	2·793	1·064	·830	2·249	6·936	240,820	1·817	1·238
Leith	3·828	4·985	21	37	7	315	1·56	·63	2·476	·692	·66	1·157	4·985	971,699	1·026	1·13
Lincoln	4·903	6·699	4	8	7	72	1·75	·428	2·513	1·477	·913	1·796	6·699	164,314	1·50	1·197
Liverpool	5·655	7·635	389	494	8	5,446	2·375	·43	2·945	1·079	1·631	1·980	7·635	20,381,934	1·177	1·682
Lowestoft	4·15	6·37	14	19	8	196	univ'rs'l penny fare		2·56	·60	·99	2·22	6·37	356,551	2·14	1·04
Maidstone	3·854	6·160	5	7	6·4	71·66	1	1	2·066	1·002	·786	2·306	6·16	206,932	1·75	1·31
Manchester ...	5·00	7·03	425	566	7·37	6,175	2·12	·56	3·04	·98	·98	2·03	7·03	25,072,791	1·239	1·61
Nelson	3·971	6·457	6	9	10	108	1	1	2·494	·452	1·025	2·486	6·457	252,546	2	1·24
Newport (Mon.) ...	4·729	6·794	26	40	6·67	390	1·62	·61	2·305	·944	1·530	2·015	6·794	1,153,398	1·35	1·49
Nottingham ...	5·14	7·12	77	115	6·50	15	1·62	·65	2·94	1·10	1·10	1·98	7·12	4,316,656	1·25	1·61
Oldham	4·297	7·145	48	80	6·50	864	1·12	·871	2·652	·570	1·075	2·848	7·145	3,453,037	1·50	1·89
Perth...	3·473	5·294	8	12	6·25	120	1·01	1·073	2·619	·708	·146	1·821	5·294	279,694	1·40	1·21
Plymouth	4·999	7·276	28	42	7·25	336	1·75	·75	2·267	·908	1·715	2·386	7·276	938,006	1·75	1·34
Rochdale	4·065	6·028	33	59	7	495	1·14	·95	2·725	·462	·878	1·828	5·893	1,896,278	1·16	1·69
Rotherham ...	4·640	7·318	17	31	8	272	1·6	·62	2·937	·860	·843	2·678	7·318	1,103,804	1·50	1·785
Salford ...	4·418	6·476	125	177	7·75	2,125	1·50	·59	2·791	·662	·965	2·058	6·476	7,983,603	1·358	1·53
Southampton ...	5·366	7·679	45	51	7	557	1·25	·75	2·947	·944	1·475	2·313	7·679	1,333,050	1·98	1·17
Southport	4·282	6·017	14	26	6·5	210	1·3	·72	2·415	·883	·981	1·735	6·016	504,385	1·50	1·16
South Shields ...	3·37	5·20	15	35	6·89	222	1·50	·62	2·16	·79	·42	1·83	5·20	710,234	1·44	1·27
Stalybridge, etc....	3·840	5·389	41	55	6·75	577	1·24	·8	2·515	·630	·695	1·549	5·389	2,203,128	1·0	1·549
Sunderland ...	4·374	6·379	45	70	7	726	1·44	·68	2·879	·845	·650	2·005	6·379	1,826,167	1·69	1·18
Wallasey	5·082	7·562	29	35	7	435	1·50	·62	3·26	·89	·931	2·48	7·562	1,316,215	1·62	1·52
Walsall	4·760	6·314	17	28	7	255	1·24	·83	2·687	·949	1·123	1·555	6·314	662,582	1·50	1·043
Warrington ...	4·821	6·950	11·386	21	6·46	182·17	1·25	·803	2·790	·815	1·216	2·129	6·950	610,115	1·50	1·42
West Ham... ...	5·314	6·798	80	100	6¾	1,040	1·85	·56	3·723	·738	·853	1·484	6·798	3,797,337	·99	1·48
Wigan	5·62	8·07	48	67	8	960	1	1	2·543	1·33	1·75	2·45	8·07	2,369.000	1·50	1·63
Wolverhampton ...	4·252	6·095	30	43	6½	420	1·125	·867	2·487	·823	·942	1·843	6·095	1,582,325	1·125	1·638
Yarmouth (Gt.) ...	4·12	5·693	22	31	6	324	1	1	2·612	·742	·766	1·573	5·693	539,902	1·75	·897

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

															Works Cost.	
Belfast	3·96	4·68	199	232	8·75	1,931	2·33	·40	2·48	·56	·92	·72	4·68	6,434,835	·59	1·21
Bexley	5·529	7·904	...	16	7·5	...	1·31	·80	2·885	1·174	1·470	2·375	7·904	408,497	1·561	1·52
Birkenhead ...	5·009	6·07	43·55	59	7·128	509	1·38	·64	2·727	·922	1·360	1·061	6·070	2,398,274	·58	1·81
Bournemouth ..	5·29	7·27	57	81	6·61	1,026	1·16	·87	3·07	·84	1·38	1·98	7·27	2,676,833	1·306	1·51
Cardiff	5·311	5·95	87	130	6·50	1,104	2	...	3·374	·858	1·079	·64	5·95	4,842,074	·35	1·84
Glasgow	5·353	5·721	543·98	780	7·91	7,616	2·29	·45	2·890	1·023	1·440	·369	5·721	24,974,056	·301	1·23
Huddersfield ...	4·65	5·32	44·25	70	6·6	708	1·25	·82	2·52	·52	1·61	·67	5·32	3,722,598	·33	2·04
Hull	4·93	5·69	71·25	116	10	1,140	2·75	·36	2·48	·73	1·72	·76	5·69	3,582,831	·63	1·21
Leeds	5·02	5·58	186	270	7·21	2,790	1·95	·54	2·84	·96	1·22	·56	5·58	13,091,475	·32	1·75
Leicester	4·377	4·965	92	140	8	1,472	2·15	·493	3·018	·635	·724	·588	4·965	5,349,665	·358	1·60
London	H 5·622	10·117	466	723	6	6,291	...	...	3·506	1·212	·904	4·495	10·117	32,782,702	·596	2·02
	E 5·704	6·906	420	671	8·5	6,300	...	...	3·156	1·308	1·240	1·202	6·906			
N'castle-on-Tyne...	5·23	6·04	111	187	7	1,665	1·58	·65	3·15	·93	1·15	·74	5·97	7,659,050	·41	1·80
Northampton ...	3·99	5·00	16·50	22	5·6	264	1·34	·68	2·55	·85	·59	1·01	5·00	878,889	·625	1·62
Portsmouth ...	4·384	4·991	73	100	6	15	1·50	·85	2·891	·835	·658	·607	4·991	2,230,460	·599	1·378
Preston	4·929	5·514	20	30	7·36	360	1	·95	2·671	1·195	1·063	·585	5·514	1,461,304	·362	1·469
Reading	3·88	4·77	25	36	7	400	1·47	·69	2·224	·973	·684	·889	4·770	1,090,416	·75	1·053
Sheffield	5·202	5·940	178·23	263	6·727	2,940	2·50	·38	3·442	·714	1·046	·738	5·940	11,546,500	·391	1·697

C—Cable line. E—Electric trolley system. H—Horse lines. * And general.

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be issued, of which 30,000 would be offered at par to the shareholders for subscription, and that would provide £30,000 for working capital and for redeeming debentures; the second debentures the creditors were asked to take. After a short discussion a committee representing English and Scotch creditors was appointed to go into the matters detailed by the Chairman, such committee to report the result of their labours to the creditors.

London United Tramways, Limited.—The report of the directors for the year ended December 31 last states that the operation of the company's undertaking resulted in gross receipts amounting to £345,570, and the working and general expenses, maintenance and repairs to £214,672, leaving, with the balance brought forward from last account, a net revenue of £131,747. After payment of interest on debenture stock and loans and the dividend on the 5 per cent. preference shares for the year, and providing for income tax, there is a balance of £10,260. An interim dividend at the rate of 2 per cent. per annum, less income-tax, amounting to £8,973, was paid in August last, leaving £1,287, which the directors propose to carry forward. The gross receipts show an increase of £17,674, and the total number of passengers carried was 58,725,980, an increase of 3,370,699. The profits have not permitted of any appropriation to the renewal fund, which it is the desire of the directors to augment year by year. The section of the company's system in Surrey, from Raynes Park to Wimbledon and Tooting, about 6½ miles of tramway, was completed and opened for public traffic in June last. The tramway mileage now in operation consists of 55¼ miles. It is with regret that the directors record the fact that owing to the exceptionally cold and wet summer season, receipts for the second half of the year's working have proved to be disappointing. At a meeting of the company on March 27 at which the report was adopted, Mr. C. J. Cater Scott, the chairman, said that the directors did not deem it wise to undertake any new works beyond the electrification of the Kew and Richmond line and the carrying of the tramway over Kew Bridge. The expansion of the traffic had not been favourable, for they had had very bad weather which affected adversely the pleasure traffic in the Thames Valley. The influences of wet or fine weather were enormous. In a wet week ended July 5 they took £7,231, and in a fine week to July 19 they took £8,473, and the difference was entirely due to the weather and no outside circumstances at all. In law costs and compensation they had suffered. It seemed that the tramway companies were fair game to be shot at, and in accidents public sympathy went against the company. They tried wherever possible to settle out of court. The cars were being kept in the highest state of efficiency. In 1906 they had 300 cars, and in 1907 they had 340, and the additional 40 were larger cars. It was a matter of great regret that they had not been able to add to the reserve funds either for contingencies or renewals. Their desire was to increase these funds whenever it was possible. He saw no reason for any despondency as regarded the immediate outlook. With any return to normal weather they ought to look to a large growth of traffic in the Thames Valley, and there should also be additional traffic in connection with the Franco-British Exhibition at Shepherd's Bush, for their cars ran to the very doors, and they ought to carry a fair proportion of the large concourse of people who would throng there from May onwards.

NEW CONTRACTS AND ORDERS.

The British Chilled Iron and Steel Company, Limited, are supplying steel tyres to the Yarmouth tramways.

Babcock and Wilcox, Limited, have received an order from Barnes Urban District Council for a locomotive crane, at £855.

Derby Town Council has purchased a Tirril regulator from the British Thomson-Houston Company, Limited, at £82 10s.

The British Thomson-Houston Company, Limited, has received an order from Blackburn Corporation for tramcars and equipments.

Messrs. L. P. Winby and Company have received a large order from the India Office for coach screws for the Indian State Railways.

The Lahmeyer Electrical Company, Limited, will supply service cables to the Lowestoft Town Council at the average rate of £248 per mile.

The Tudor Accumulator Company is supplying to Whitehaven Town Council a battery of 244 cells, which the company are to maintain for ten years at £113 per annum.

Messrs. Bruce Peebles and Company have been awarded the contract for three 3-phase direct-current converters to be supplied to the Bristol Electricity Committee at £3,647.

Dundee Electricity Committee have accepted the tenders of the British Thomson-Houston Company and the British Westinghouse Company for switch gear and transforming plant.

The British Insulated and Helsby Cables, Limited, have an order from the Postmaster-General's department, Hobart, Tasmania, for lead-covered cable.

Portsmouth Tramways Committee have accepted tenders by Pearson, Huggins, and Company, London, for clothing for motormen, conductors, and inspectors, at £634 4s. 6d.

The Empire Roller Bearings Company, Limited, has received an order from Wolverhampton Corporation tramways to fit additional cars with roller-bearing axle boxes.

The Continuous Rail Joint Company, Limited, have received an order from the Indian Government for a further supply of continuous rail joints for the Eastern Bengal Railway.

Messrs. Browett, Lindley, and Company have received an order from Yarmouth Town Council for a 580 H.P. engine, to be coupled to a Crompton dynamo, at £1,681 for the set.

Johannesburg Corporation have placed orders with Reunert and Lenz for a 1,000 KW. Belliss-E.C.C. two-phase alternator, at £10,950; a 500 KW. Belliss-E.C.C. two-phase alternator, at £4,567; and three Babcock and Wilcox boilers, at £7,095.

The Frodingham Steel and Iron Company have placed a repeat order with the Lancashire Dynamo and Motor Company, Limited, for a 500-KW. generator. This machine will be direct-coupled to a gas engine running at 120 revolutions per minute.

Messrs. H. Lotery and Company, 4 to 8, St. Mary Street, London, N.E., have recently secured contracts for uniform clothing from Blackpool Corporation tramways, Oldham tramways, Bolton tramways and gas undertakings, Nelson tramways and a Guernsey railway company.

Messrs. Ed. Bennis and Company, of Little Hulton, have received an order for two stokers and self-cleaning compressed air furnace for a new Lancashire boiler for the Blackpool Corporation electricity works. This is a repeat order, the corporation having used "Bennis" stokers for more than five years.

William Griffiths and Company have been awarded a contract by Islington Borough Council for paving works to be carried out in connection with the reconstruction of the London County Council tramways in Caledonian, Camden, and Seven Sisters Roads, and for paving the margins of Archway Road. The value is £24,744.

Johnson and Phillips, Limited, inform us that they have recently closed the following contracts; Manchester Corporation, for the supply and erection of three-phase transformers for one of their sub-stations; Hucknall Colliery, for the supply and erection of three-phase high-tension overhead transmission lines; and Bristol Docks Committee, for the complete installation of cable, switch-gear, arc lamps, etc., for Avonmouth Docks.

London County Council have accepted the following tenders: Rebuilding of two bridges in Caledonian Road in connection with tramway electrification, Dick, Kerr, and Company, Limited, £6,895; 525 tons of track rails and fastenings, Walter Scott, Limited, £3,978; 10-ton overhead travelling crane for Hammersmith sub-station, John Smith (Keighley) Limited, £159 10s.; points and crossings for Brixton Road to Camberwell Green tramways, Hadfield's Steel Foundry Company, £838 12s. 6d.

Mellowes and Company, Limited, of Corporation Street, Sheffield, have recently received orders for glazing, with their "Eclipse" patent imperishable system, the roofs of works extensions, for Messrs. Platt Brothers and Company, Oldham; the Birmingham Railway Carriage and Wagon Company, Limited, Smethwick; the Brightside Foundry and Engineering Company, Limited, Sheffield; the new chemical works at Birkenhead; the public library, Dublin Corporation; the University Buildings, Leeds; and the carriage shed of the Great Central Railway at Ardwick.

Mirrlees, Watson and Company, Limited, Glasgow, have recently received orders for a number of condensing plants, among which are the following: Bolckow, Vaughan and Company, repeat order for Auckland Park Colliery; Garton, Hill and Company, Battersea, surface condensing plant; Nobel's Explosives Company, Limited, Stevenston, elevated self-draining jet condenser; Bolckow, Vaughan and Company, for Cleveland Ironworks, South Bank, two surface-condensing plants; Fraser and Chalmers, elevated jet condenser for Australia; and one surface-condensing plant for Leeds lighting department.

Fastnut, Limited, inform us that the sale of the "Fastnut" washer is increasing rapidly. A large order has recently been received from the Oceanic Steam Navigation Company, Limited, and washers have also been supplied to the Cunard Steamship Company. Many of the railway companies are taking larger quantities of "fastnuts" each month. The order of the North Eastern Railway, for instance, now amounts to some hundreds of gross per month. Local authorities are using the washers largely, and in the motor trade they are becoming very popular, manufacturers of commercial vehicles making general use of them.

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PERSONAL.

Mr. F. E. Saunders, manager of Maidstone Corporation tramways, has been granted an increase of salary.

Mr. H. Webber, of Hastings, has been appointed assistant engineer in the Sunderland Corporation's electricity supply department.

Mr. W. C. P. Tapper, electrical engineer, of Stepney Borough Council, has been voted an increase of salary from £650 to £750.

Mr. W. J. Bache, electrical engineer of Cheltenham, has been voted an increase in salary to £450 per annum.

Mr. C. Gordon-Young has been appointed honorary secretary to the Income Tax Reduction League, in succession to Mr. R. Stephenson.

Mr. John Varley has been appointed a director of Callender's Cable and Construction Company, to fill the vacancy caused by the death of Sir D. Evans.

Mr. F. Spencer, the late manager of the Halifax Corporation tramways, has been presented by the employees with a Doulton dinner service, as a mark of their esteem.

Mr. J. McMahon, electrical engineer of Northampton Corporation tramways, has been appointed electrical engineer and manager to the Dumbarton Tramways Company.

Mr. G. Marconi has been appointed managing director, both of the Marconi Wireless Telegraph Company and the Marconi International Communication Company, Limited, in succession to Mr. H. Cuthbert Hall.

Mr. James Slevin will remain as electrical engineer at Wigan, and will have charge of the maintenance and electrical equipments, both underground and overhead, of the tramways, of the engineering shops, and of the cleaning and repair staffs at the central car sheds.

Mr. H. R. Forbes Mackay, formerly resident engineer for the London District of the electrical engineers' department of the Great Western Railway, has been appointed electrical engineer to the Sydney Municipal Council, New South Wales, and has sailed to take up the appointment.

Mr. Norman A. Thompson will continue the business of consulting electrical engineer hitherto carried on by Messrs. Thompson and Wilson, 22, North Bridge Street, Edinburgh. The partnership between Messrs. Thompson and Wilson has been dissolved by mutual consent, Mr. Wilson retiring from the business.

Mr. S. T. Allen, chief assistant electrical engineer to Plymouth Corporation, has been presented with a silver fruit dish from the staff and employees of the electrical engineers' department, and a silver inkstand from the principal electrical contractors of Plymouth. Mr. Allen is about to take up the duties of city electrical engineer at Carlisle.

Mr. Charles H. Merz has returned to London from Melbourne, where he has been investigating the proposed electrification of the Melbourne suburban railway lines on behalf of the Victorian Government. It is understood that Mr. Merz has been asked to give an estimate for the electrification of the St. Kilda and Port Melbourne lines, and also to report in regard to the use of electricity in the railway workshops at Newport. It is not anticipated that tenders will be invited for some months.

Sir Clifton Robinson, who returned on March 7 from a tour round the world, has received some impressions which ought to be useful to tramway managers in the metropolis. The truth of three facts which he has stated cannot be denied. These Sir Clifton tabulates in the following form: 1. Our tramway cars do not travel fast enough. 2. The double-deck tramway car is the cause of much lost time. 3. The volume of traffic at rush hours could be handled more successfully were the authorities to remove the present restrictions regarding overcrowding.

The Warner Engineering Company.—Mr. J. Sutherland Warner is making an extended visit abroad, and some re-organisation of the staff of the Warner Engineering Company has taken place. Mr. E. C. Mackellar, who joined the staff of the company last year, has become managing director, and Mr. J. A. O'Brien has been appointed technical director. Mr. Mackellar has had an extensive experience in traction and lighting work, both with Messrs. Bruce Peebles and Company, and previously with Messrs. Vickers, Son and Maxim. Mr. O'Brien has recently resigned the position of manager of the Barnsley tramways.

Mr. William Wood, of 110, Cannon Street, London, E.C., informs us that he has been appointed sole selling agent for London and the South Eastern Counties for the Macallen Company, of Boston, U.S.A. The manufactures of this company are well known in this country, the whole of the insulating material in use on the underground railways of London having been supplied by them. Amongst the specialities now on the market are section insulators of improved design for overhead trolley lines, pneumatic insulating joints for air brake equipments, and arc light suspensions specially constructed to withstand the different voltages required.

South Shields Tramway Manager.—South Shields Town Council met for the fifth time on Monday last, to continue a debate on a proposal by the Tramways Committee that Mr. J. Wilson, the tramway manager, should be given three months' notice to terminate his engagement, in the event of his not sending in his resignation. Mr. Wilson made a statement dealing with various charges against his management. He complained that he had not had adequate assistance in the management of the system. The least that could be granted him was that for a reasonable period he should be afforded a fair chance of continuing his management with his present staff, and if at the end of that period he did not give satisfaction, he would at least not be able to complain that he had not had a fair trial. After two amendments had been defeated, the committee's recommendation was agreed to by 26 votes to 22.

Nottingham Manager's Salary.—At a private meeting of Nottingham Town Council on March 2, a discussion took place on the recommendation by the Tramways Committee that the salary of Mr. John Aldworth, general manager of the tramways, should be increased to £1,000 a year. It was stated that the Committee were practically under an engagement to increase the salary to £1,000 per annum, as when Mr. Aldworth had a situation offered to him by another Corporation a few years ago at a much larger salary than that paid by the Nottingham Committee, the promise was then made to him that if he remained in Nottingham his salary should be increased to £1,000 a year. Relying upon the promise then made, Mr. Aldworth decided not to leave the town. When Mr. Baker, the late manager, accepted the appointment of tramways manager under the London County Council, the Nottingham Committee offered him £1,000 a year to continue in Nottingham, but the London County Council refused to release him from his appointment. In the course of the discussion figures were produced to show how great has been the development of the Nottingham tramway system during Mr. Aldworth's managership, which dates from 1899. In the interval the receipts have grown from £42,480 to £154,000, and the passengers have increased from 7,785,000 to 34,600,000. Wages of employees have been raised and surpluses earned which have enabled £93,000 to be paid in relief of rates. The Council finally decided that the salary should be increased from £800 to £900.

The Late Mr. W. O. Callender.—We regret to announce the death of Mr. William Ormiston Callender, the founder of Callender's Cable and Construction Company, Limited, which took place at his residence in Bournemouth, on March 14. Mr. Callender was born in Leith in 1827, and was consequently 81 years of age at the time of his death. He settled in London in 1866, and shortly thereafter became connected with the paving industry. As manager of the Val de Travers Company, he introduced asphalte into London as a material for street paving in 1869. Subsequently he became managing partner of the Seyssel Mines Company, and had much to do with street paving contracts in France, in Germany, in Russia, and Roumania. He was largely responsible for the introduction into Europe of asphalte from the well-known pitch lake in Trinidad. In 1879 he patented an insulating material in which Trinidad bitumen formed the chief ingredient, and this material has become widely known as a dielectric for underground mains, under the name of "vulcanised bitumen." The Callender's Bitumen Telegraph and Waterproof Company was founded in 1882, to develop this invention. The present company, Callender's Cable and Construction Company, Limited, is its successor, and is too well known to our readers and the electrical industry throughout the world to require further reference. Mr. W. O. Callender ceased to take a part in the working management of the company's affairs in 1893, but remained an active member of the board until 1903, when he resigned his seat as director, but was appointed special director of the company. Mr. W. O. Callender has been twice married, and by his first wife had a family of ten children, all of whom, as also his widow, survive him.

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TRAMWAY AND LIGHT RAILWAY NOTES.

BATH.—The tramways company, having found that their present low fares are unremunerative, intend to make application to the Board of Trade for authority to increase the fares on the western section of their lines. At present passengers using workmen's tickets are able to travel nearly five miles for a penny.

BIRMINGHAM.—Handsworth Tramways Committee reported, at a meeting on March 18 of the District Council, that the Board of Trade having on March 7 approved of the proposed service of notice under section 43 of the Tramways Act, 1870, requiring the City of Birmingham Tramways Company to sell to the Council so much of the cable tramway as is within the Urban district of Handsworth, the notice was served on the company on March 10. Negotiations as to the future working of the tramways in the district are proceeding.

BOLTON.—The Town Council of Bolton have, by a large majority, approved of a scheme for the carriage of parcels on the tramway cars under the auspices of the Bolton Combined Traders' Association. The arrangement is to be tried as an experiment for one year.

BRADFORD.—Mr. C. J. Spencer, general manager of Bradford Corporation tramways, has presented a report to the Tramways Committee on the possibility of further increasing the facilities now offered to workmen. Mr. Spencer finds that the Bradford workmen's fares are lower than the average workmen's fares on other tramways, that the issue of return tickets would not greatly affect the average workman, that to charge half the ordinary fare to workmen would in all probability result in financial disaster, and that the ordinary fare is considerably less than the average ordinary fare elsewhere. The department has long since abandoned the attempt to discriminate between the *bona fide* workman and other passengers. There is at present a universal fare of 1d. before 8 a.m. On an average passengers may travel 4·16 miles for one penny. The return fare is at the ordinary rate, that is ·501d per mile. So that taking the average between the morning rate of 240d. and the evening rate, the average rate for return workmen's fares is ·370d. per mile, as against the statutory workmen's fare limit of ·5d. per mile. The average workmen's fare rate on all municipal tramways throughout this country is ·406d. The loss from issuing return workmen's tickets he estimates at £46 a week. The Tramways Committee have approved the report.

BURY.—Rather an interesting case from the point of view of discipline of employees came before Bury Town Council on March 5. A motorman had been suspended by the manager for five days for infringing a rule which provides that an employee shall not perform any work in connection with the Tramway Workers' Association on Corporation premises, and the committee had declined to alter the penalty. Colonel Hall, chairman of the Tramways Committee, said that at the request of a number of men who were being intimidated and interfered with by members of the Union the committee issued an order that no business of the Union must be transacted upon the tramway premises. The motorman in question, who had recently been appointed local secretary to the Union, admitted filling up membership cards on the premises. Mr. W. E. Turner, a labour member, proposed that the matter be referred back. The motorman lost wages to the amount of £1 3s. 1½d. for making out a collecting card for a man who asked him to do it in a tramway waiting-room. He was off duty at the time. In Manchester and Salford every facility was afforded the Union officials for collecting subscriptions from the men. Colonel Hall, in reply, spoke of the importance of maintaining dicipline, and said that so long as the rule existed the manager was bound to see it carried out. The committee had no objection to the men joining the Union. Mr. Turner's motion was defeated by 21 votes to 7.

DUBLIN.—At the fourteenth annual meeting of the Dublin Tramway Employees' Provident Society, the report for 1907 was submitted and approved. It stated that the total subscriptions, levies, etc., paid into benefit fund during the year amounted to £1,497 13s. 8d., of which the Committee expended for sick benefits, medical aid, etc., to 374 members, and mortality allowances to the representatives of 16 members and six members' wives deceased, the sum of £1,262 19s. 4d., leaving a balance of £235 14s. 4d. available for dividend. Of this sum, £203 11s. 3d. was distributed amongst the members at the rate of 5s. per fully-paid member, and £32 3s. 1d. carried to next account. The Provident Fund had to its credit at the beginning of the year £3,408 10s. 9d. Income from all sources was £565 11s. Grants to 21 members and 13 members' widows amounted to £147 5s., leaving on December 31 a credit balance of £3,826 16s. 9d., of which £3,200 is invested in Dublin United Tramways Stock.

DUNDEE.—At a meeting of Dundee Tramways Committee on March 9, it was agreed that the employees should be relieved, as at present, for their annual holiday on a Saturday night, but that, instead of returning to work on the following Saturday morning, they should be free until the Monday morning, and that six days' pay should be granted. It was also arranged that the hours of spare drivers should be nine per day, or 54 per week, and that the minimum wage for spare conductors should be 18s., rising by 1s. every three months to 21s. at the close of the first year.

EDINBURGH.—A syndicate interested in Cope's shallow conduit system of electric traction have offered to Edinburgh Town Council to lay and equip at their own expense a tramway line on that system from Murrayfield to the gates of the forthcoming Exhibition. The hope is to demonstrate the capabilities of the system. The present tramway terminus is about three-quarters of a mile from the Exhibition gates. The offer by the syndicate came before the Council on March 17, when it was intimated that the Edinburgh and District Tramways Company would co-operate in working the proposed line. It was agreed to remit the matter to the Tramways Committee and the Streets and Buildings Committee, with powers.

HUDDERSFIELD.—It is reported that a new company will shortly be registered for the purpose of constructing about eight miles of electric tramways, providing junctions at Elland, Halifax, and Brighouse, with the Huddersfield and Halifax tramway systems.

HULL.—Social tastes and a love of flowers are two desirable things which the Hull Corporation tramway employees have opportunities of cultivating. The men, with their wives and friends, were recently entertained at tea by the Tramways Committee, when about 600 persons were present. A musical programme and dance followed. Among those present were Alderman Larard, chairman of the Tramways Committee; the Mayor (Alderman Feldman); Alderman Robson, deputy-chairman of the Committee; Mr. W. J. McCombe, tramway manager; and Mr. J. Wilkinson, tramway electrical engineer. On March 11 the men's hyacinth show took place, when a large number of competitors exhibited very fine specimens of the flower, and prizes were awarded.—The Tramways Committee on March 27 approved a scheme involving the removal of lavatory buildings in front of St. John's Church in City Square, and the erection of a number of shops on the site at a cost of about £8,000. The scheme provides for an underground lavatory, and for offices and stores in connection with the tramway undertaking.

LIVERPOOL.—The Liverpool Town Council has adopted the Tramway Committee's scheme for providing retiring allowances for men when they reach the age of 60, if they are then compelled to abandon the service. Under the scheme the men will contribute 2d. per week and the Corporation the same amount. Sir Charles Petrie, chairman of the Tramways Committee, stated that the object is not to pension men, when they reach a certain age, but to give them a retiring allowance when they felt incapable of work. The Committee do not wish to discharge men at a stated age, but prefer to give them a chance of working at a lighter employment. The retirement under the new scheme will not commence until ten years have elapsed, by which time it is expected that the funds will amount to between £30,000 and £40,000.—At a meeting of Liverpool Tramways Committee on March 20, Mr. Mallins, the traffic manager, reported, in reference to a notice of motion on the Council agenda asking for the provision of cheap fares for workmen and school children, that at the present time the service between 4-30 a.m. and 8 a.m., which was chiefly for the benefit of workmen, earned 9·77d. per car mile, as compared with 10·104d. per car mile for the rest of the service. It represented a loss of £914 per annum on the actual working expenses, and £6,090 per annum in decreased takings. He had information from London, Glasgow, and Bradford, where they had cheap workmen's fares, and they all reported a loss on that part of the service. If the committee decided to extend the cheaper fares and to include children, more rolling stock would be required, and, considering the longer penny stages in Liverpool, the change might easily produce a loss for the whole of the tramways. The committee adopted the manager's report.

MAIDSTONE.—The Town Council of Maidstone have acceded to a request from the motormen and conductors that their duties should, as far as possible, be worked in one shift, that they should have one day off in seven, that the total working hours per week should be 60, and that all working time over that figure should be reckoned and paid for as overtime.

MIDDLESEX.—Justices Darling and Phillimore in the King's Bench Division, on March 6, gave judgment in the case of the Assessment Committee, of Hendon *v.* Sir R. Littler and others. The Committee applied for a rule *nisi* calling on the respondents, who are justices of Middlesex and also members of Middlesex County Council, to show cause why a writ of prohibition should not issue, precluding them from sitting on the bench when an appeal by the Metropolitan Electric Tramways, Limited, against the assessment of their undertaking, was heard. Mr. Justice Darling said that the company worked tramways which were leased to them by the County Council, which latter body received 45 per cent. of the net revenue of the undertaking. This net revenue was arrived at by deducting, among other things, the rates which were paid by the Tramway Company. The objection of the Committee to the justices sitting as justices during the appeal was that they had a pecuniary interest. He thought that a case had been made out for a rule *nisi* for a writ of prohibition.—Mr. Justice Phillimore was of the same opinion, and the rule *nisi* was accordingly granted.

OXFORD.—An agreement has been arrived at between the Oxford Tramway Company and the National Electric Construction Company not only for the settlement of the arbitration proceedings, but for an

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amalgamation with regard to the electrification of the Oxford tramways. It is proposed that a new company should be formed which would receive on the one hand the concession from the Corporation, and on the other the plant and properties of the existing tramway company. The settlement of the arbitration will have to receive the consent of the Oxford Corporation, as the arbitration is nominally between them and the old tramway company.

PORTSMOUTH.—The Portsmouth Corporation tramway employees on March 10 entertained over 300 poor children to tea. Subsequently a concert was given. The men were supported in their efforts by the presence of Alderman J. H. Corke, chairman of the Tramways Committee; Mr. J. Timpson, vice-chairman; Mr. W. R. Spaven, tramway manager; Mr. V. Lironi, engineer; and Mr. W. Munford, traffic superintendent.

POTTERIES.—The secretary of the Potteries Electric Traction Company has written to the Town Clerk of Stoke-on-Trent stating that the directors of the company have resolved for the present, in deference to the wishes of Stoke Town Council and other local authorities of the district, to permit the holders of workpeople's weekly tickets to use them on all cars on the outward journey up to 9-30 in the morning, and, further, have decided to remove all restrictions as to the hours the tickets will be available for on the return journey. A similar letter has been sent to the Town Clerks of the other Potteries towns.

RAWMARSH.—Judging from recent reports from Rawmarsh, the Dolter Company do not appear to have overcome entirely their difficulties with regard to "live studs." The Rawmarsh Council at a recent meeting had under consideration a proposal that the company should be asked to dispense with the surface-contact system and adopt overhead wires. It was not, however, deemed advisable at present to proceed to that extremity, bnt the opinion was freely expressed that unless something was done to render the streets free from the mishaps and danger experienced since the opening of the tramways, public safety would require a removal of the causes of the alarm and losses. The immediate causes of the discussion at the council meeting were the death of another horse caused by a shock received from a live stud, and the receipt of a letter from the manager of the Aldeworke Main Colliery complaining of injuries being done to their horses when carting coals through the district, by electric shocks, and asking for some further safeguard to be adopted. This communication has been forwarded to the company, and also that a letter has been sent to the Board of Trade calling attention to the dangers from "live studs." and urging that an inquiry should be held.

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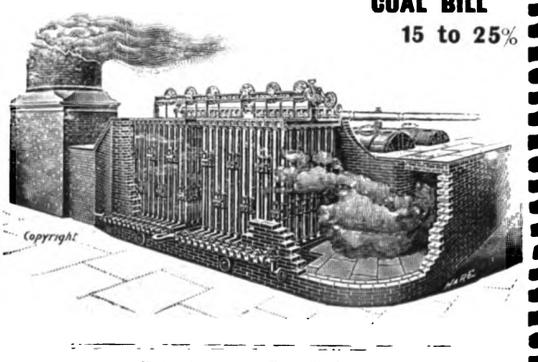

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SHEERNESS.—A committee has been formed at Minster-on-Sea to arrange for the application for a light railway order, authorising the extension of the electric tramway from Sheerness to Minster-on-Sea. The existing line, which is 2½ miles long, is one of the British Electric Traction Company's undertakings.

SHEFFIELD.—It is announced that Sheffield Corporation have abandoned the idea of purchasing motor omnibuses to run on routes not served by the tramways. The tramways will be extended so as to include places to which it was proposed omnibuses should run.

SWANSEA.—A parcel service is being started in connection with the Swansea tramways and the Mumbles railway. Parcels are collected and delivered by messengers in uniform Including collection or delivery within half-a-mile of any part of the lines, the rates for packages are as follows: Not exceeding 14 lbs., 2d.; 28 lbs., 3d.; 42 lbs., 4d.; 56 lbs., 5d. Agencies have been established at distances of about every half-mile on the tram routes, denoted by an enamelled sign. In addition, conductors have instructions to receive parcels at any of the recognised stopping-places. The carriage can be either prepaid, or the charges collected from consignee. To places on the Mumbles railway the rates are: Not exceeding 28 lbs., 3d.; 56 lbs., 5d. Special waterproof hampers and bags have been provided to ensure efficient protection.

SWINDON.—The final results to the ratepayers of Swindon of the tramway accident which occurred on June 1st, 1906, appear now to have been reached. Five persons were killed in the accident and a large number injured, and the claims were numerous and heavy. There have been two special rates of a shilling in the £1, one of sixpence, and a final extra rate of a penny has now been imposed.

SWINTON.—A private conference of representations of the Urban District Councils of Mexborough, Swinton, and Rawmarsh, was held on March 24 to consider certain proposals by the Mexborough and Swinton Tramways Company. The results were reported to a meeting of the Swinton Council on March 25 by Mr. J. A. Bower. He said that Mr. Stanley, engineer to the company, had requested that the Councils should waive their demand for £300 due as rent for the first three years, but that the whole £700 should be paid during the last four years. Mr. Stanley had offered either to improve the present Dolter system at a cost of £3,000, or to substitute the trolley system at a cost of from £6,000 to £8,000. Mr. Stanley, however, could give no undertaking that the improved Dolter system would be satisfactory, but his suggestions as to the trolley system were satisfactory. The following resolution was carried by the conference: "That, subject to the approval of the Councils, this meeting is of opinion that in the event of the tramway company installing the overhead system in lieu of the present Dolter system, it would be desirable to meet the company in deferring the rents for the first three years, provided the whole of the rents be paid within the seven years." The report was adopted by the Swinton Council.

WEST HAM. The Tramways Committee propose to make an extension of one of their lines at an estimated cost of £2,600.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

∴ If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS.

Applications for Letters Patent have been filed:

4,112 Section insulating arrangements in overhead construction of electric railways or tramways—Siemens Brothers Dynamo Works, Limited *(Siemens Schuckertwerke G. m.b H.)*

4,191 Mechanical tilting sand-gear for electrical tramcars—J. R. Flint.

4,193 Controllers for electric motors—H. Lyon.

4,218 Automatically lubricating rails—E. Tilston and The Forced Lubrication Company.

4,267 Electric motors—A. Lehmann.

4,268 Mounting or suspension of chassis frames of motors—W. A. P. Werner.

4,316 Trolley heads for electric tramcars—J. E. Slater.

4,325 Brake mechanism for tramcars—G. Dearle.

4,364 Generation of electricity on railway trains—J. H. Sveinbjornsson.

4,368 Electrical operation or control of railway points—W. R. Sykes.

4,509 Guides for pulleys of trolley heads for tramcars—T. Pidd.

4,637 Electrically-driven trackless train—F. Wagner.

4,646 Brakes for tramways and railways—P. J. Pringle.

4,799 Controllers for electric motors—Crompton and Company, Limited, and C. Crompton.

4,831 Automatic tramway and railway switches—A. R. Levy.

4,857 Track brakes for tramways and railways—The British Thomson-Houston Company, Limited, and W. Park.

4,900 Device for cleaning treads of tramway rails—J. Upton.

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4,955 Wheels and axles for absorbing vibration—F. S. Brereton and H. M. Rogers.
4,993 Brakes for tramways and railways—G. F. Rawcliffe.
5,015 Bonding rails—G. Harrison.
5,016 Bonding rails—G. Harrison.
5,290 Rail joint—A. Knüttel.
5,457 Brakes for tramway cars—J. Wandrum, Jun.
5,466 Trolley head for electric traction cars—S. Westwood.
5,467 Guards or protectors for tramway cars—J. Muckersie and D. M'Callum.
5,489 Electrical control of railway traffic—W. R. Sykes, W. R. Sykes, Jun., and C. J. Cooke.
5,492 Rail brace—C. Ropp.
5,510 Braking systems using electric motors as generators—British Thomson-Houston Company, Limited (*General Electric Co.*)
5,529 Controllers for electrically-driven cranes—W. Fox.
5,633 Non-skid device for motor omnibuses—H. E. Scrutton.
5,684 Rail joint—T. Duysens, J. Reginus, H. D. Jon, and H. L. Kneppers.
5,686 Current-collecting device for electric railway vehicles—E. A. Christian.
5,712 Automatic exhaustion of foul air from tramcars—E. Hughes.
5,752 Axles boxes—E. J. Wood and G. Carson.
5,834 Non-skidding device for motor omnibuses—F. J. Morgan.
6,082 Electric trolleys—J. Brown.
6,334 Railroad joints—W. T. Noah.

SPECIFICATIONS PUBLISHED.

1906.

24,923 Control of electric traction systems Raworth.
25,865A Brake blocks for tramway and railway rolling stock—McCullough and Vaux.

1907.

13,323 Moving machine for treating without removal railway and other rail deformities Woods and Gilbert.
17,583 Grooved wheels for mono-railway or tramway—Kearney.
7,387 Passenger and other cars—Christianson and Standard Steel Car Company.
7,391 Body construction of passenger cars—Christianson and Standard Steel Car Company.
7,392 Passenger and other cars—Christianson and Standard Steel Car Company.
8,206 Trams, engines that run on rails for open or fixed points of rails or trolley wires, or rails or wires requiring points—Graham.
19,564 Tramcars—Kavanagh.
20,188 Life-saving attachments for railways and tramcars—Gumz.
13,361 Brake blocks for the wheels of tramcars—Earlam and Wild.
15,254 Route or destination indicators for tramcars—Anger.
19,722 Railway rails and tracks for road vehicles—Parr.
20,949 Control of electrically-propelled vehicles—Siemens Brothers Dynamo Works, Limited (*Siemens Schuckertwerke Ges.*)
11,327 Brake supporter for railroad cars—Barker (Brill).
17,097 Switch mechanism for electrically-propelled vehicles—Allgemeine Elektricitäts Ges.
18,403 Surface traversers for railways and tramways—Stokes.

1908.

870 Drive chains—Morse.

NOY'S PATENT LIFEGUARDS,
Waterside Works, Colchester.
Made to Order on Reasonable Terms.
In use on the Colchester Corporation and the West Ham Corporation Tramways.
THESE PATENT RIGHTS FOR SALE.

WANTED.
OLD STEEL TRAMWAY RAILS.
Wanted to purchase 500 tons of Old Steel Tramway Rails, 6 × 6, or 7 × 7. Apply Marple and Gillott, Limited, Engineers, Sheffield.

Mr. JOHN E. RAWORTH,
Chartered Patent Agent,
QUEEN ANNE'S CHAMBERS, BROADWAY, WESTMINSTER.

CONDENSING PLANT.
The Mirrlees Watson Company, Limited, of Glasgow, make a special feature of the manufacture of Independent Condensing Plants having either Wet or Dry Air Pumps, and suitable for working in connection with Reciprocating Engines or giving the high vacuum desirable with Steam Turbines.

axles never parallel
MAIN LINE EXPRESS — **TRUCKS** — ELECTRIC RAILWAY
MINING TRUCKS — **WARNER** — SPECIFICATION DESIGNS
ELECTRIC TRAMCAR — **SUPREME** — LICENSEES ALL COUNTRIES
WARNER ENGINEERING COMPANY DARTMOUTH ST SW ENG

TRAFFIC RETURNS.

TRAMWAYS AND OMNIBUSES.	1907. WEEKS ENDING. Mar. 2.	Mar. 9.	Mar. 16.	Mar. 23.	1908. WEEKS ENDING. Feb. 29.	Mar. 7.	Mar. 14.	Mar. 21.	AGGREGATE. Wks.	1908.	Increase or Decrease.
	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	1,161	1,241	1,092	1,163	1,131	1,216	1,149	1,134	42	57,332	– 1,240
Ayr Corporation	169	177	174	178	180	180	184	178	45	12,898	+ 19
Bath Electric	604	613	648	602	566	551	590	595	11	6,210	– 483
Belfast City	3,159	3,349	3,377	3,425	3,429	3,394	3,479	3,591	51	184,969	+ 11,838
Birmingham Corporation	5,319	5,312	5,442	5,505	6,181	6,246	6,336	6,064	12	72,085	+ 10,216
Blackburn Corporation	869	926	802	887	867	963	953	976	51½	55,509	+ 3,783
Blackpool and Fleetwood	227	224	198	207	202	240	222	214	12	2,355	+ 62
Blackpool Corporation	349	394	366	421	351	373	378	393	50	51,745	– 1,156
Bolton Corporation	2,124	1,975	1,999	2,139	2,025	2,076	2,106	2,065	51	114,186	+ 6,624
Bournemouth Corporation	1,271	1,317	1,269	1,351	1,373	1,306	1,388	1,429	50½	83,593	+ 2,379
Bradford Corporation	4,134	4,119	3,992	4,336	4,039	4,150	4,188	4,194	51	231,917	+ 5,417
Brighton Corporation	727	698	708	758	654	668	685	659	51	44,372	– 3,345
Bristol	4,591	4,625	4,483	4,683	4,505	4,473	4,578	4,324	12	54,200	– 382
British Elec. Trac. Co's. Undertakings											
Airdrie	212	213	211	216	210	215	221	219	11	2,503	+ 96
Barnsley	163	159	163	154	159	158	169	163	11	1,821	+ 108
Barrow	193	210	217	220	226	212	214	199	11	2,584	+ 54
Birmingham and Mid. Joint Com.:											
Birmingham and Midland	724	727	735	...	750	769	798	...	10	8,037	+ 676
City of Birmingham	2,612	2,627	2,628	2,655	2,662	2,679	2,762	2,640	11	30,006	+ 765
Dudley-Stourbridge	744	776	760	784	702	710	731	695	11	8,021	– 482
South Staffordshire	885	819	886	841	825	808	950	826	11	9,517	+ 238
Wolverhampton District	423	434	429	439	458	431	432	404	11	4,810	+ 58
Cavehill	55	61	48	53	49	53	57	68	11	646	+ 85
Devonport	387	415	400	410	398	397	403	380	11	4,650	– 31
Gateshead	940	952	954	985	970	949	956	955	11	11,030	+ 355
Gravesend and Northfleet	200	211	214	222	186	180	182	178	11	2,073	– 207
Greenock-Port Glasgow	463	604	589	598	437	454	477	467	11	5,202	– 1,217
Hartlepool	250	236	237	247	207	199	197	179	11	2,425	– 235
Jarrow	103	107	103	104	91	83	94	86	11	1,080	– 8
Kidderminster	82	87	89	89	85	85	85	76	11	930	– 28
Leamington	122	138	123	119	147	116	150	118	11	1,443	+ 170
Merthyr	186	192	192	204	186	190	192	199	11	2,161	+ 37

(*Continued on page 292*).

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TRAFFIC RETURNS—*continued.*

TRAMWAYS AND OMNIBUSES.	1907. WEEKS ENDING. Mar. 2.	Mar. 9.	Mar. 16.	Mar. 23.	1908. WEEKS ENDING. Feb. 29.	Mar. 7.	Mar. 14.	Mar. 21.	Wks.	AGGREGATE. 1908.	Increase or Decrease.
British Elec. Trac. Cos.—*continued.*	£	£	£	£	£	£	£	£		£	£
Metropolitan Electric	3,611	3,866	3,660	4,025	4,593	4,585	4,887	4,810	11	52,702	+ 11,333
Middleton	285	298	286	293	290	300	318	304	11	3,355	+ 184
Oldham-Ashton	533	561	544	552	551	549	564	549	11	6,225	+ 86
Peterborough	95	96	99	107	110	99	101	99	11	1,144	+ 63
Potteries	1,735	1,776	1,832	1,790	1,739	1,760	1,855	1,730	11	20,684	+ 654
Rothesay	40	49	45	52	42	44	48	49	11	540	+ 42
Sheerness	45	46	46	48	51	49	47	44	11	530	+ 12
South Metropolitan	631	662	645	715	628	618	661	641	11	7,201	+ 42
Southport	205	210	213	220	184	218	218	199	11	2,171	− 109
Swansea	728	781	734	806	806	857	837	794	11	9,234	+ 656
Taunton	36	37	37	43	38	36	38	36	11	407	− 6
Tynemouth	143	144	143	152	131	118	138	136	11	1,561	− 44
Weston-super-Mare	24	26	24	27	28	21	22	25	11	268	− 5
Worcester	210	228	229	233	232	229	231	210	11	2,578	+ 52
Wrexham and District	89	97	84	89	80	90	90	91	11	988	+ 3
Yorks. (Woollen) District	849	1,021	865	887	834	817	869	850	11	9,528	− 285
Burnley Corporation	1,085	1,174	1,080	1,128	1,114	1,214	1,128	1,107	12	19,347	+ 373
Burton-on-Trent Corporation	249	246	261	254	247	249	235	225	51	14,104	− 696
Bury Corporation	908	942	918	915	998	1,066	1,032	1,017	51	55,896	+ 6,814
Cardiff Corporation	1,820	1,915	1,901	2,014	1,860	1,915	1,913	1,860	51	107,293	+ 2,975
Carlisle, City of	130	144	146	148	155	139	139	133	12	1,744	+ 68
Chatham and District	595	627	605	654	611	611	615	572	11	6,712	− 149
Chesterfield Corporation	199	193	208	212	197	212	202	208	52	11,367	+ 607
Colne and Trawden	177	194	186	196	177	178	187	186	12	2,124	− 1
Cork Electric	368	403	399	448	382	381	369	415	11	4,324	− 270
Croydon Corporation	1,195	1,254	1,216	1,309	1,193	1,185	1,245	1,199	51	70,160	− 1,479
Darlington Corporation	189	193	201	204	197	196	193	192	51	10,625	+ 29
Derby Corporation	689	675	700	712	768	761	780	741	51	39,447	− 1,035
Dover Corporation	166	179	170	177	151	151	147	145	51	10,847	− 1,366
Dublin and Lucan	96	95	88	101	91	88	98	111	12	1,074	+ 35
Dublin United	4,336	4,570	4,544	4,997	4,618	4,626	4,693	5,034	12	53,954	+ 2,079
Dundee City	972	1,049	998	1,047	1,043	1,069	1,071	1,046	44	50,217	+ 2,254
East Ham Corporation	817	829	827	871	804	805	791	822	51	45,418	+ 347
Exeter Corporation	231	243	237	256	231	222	233	215	51	15,055	+ 449
Falkirk and District	260	...	264	...	248	259	263	250	25	4,808	—
Glasgow Corporation	16,660	16,844	16,411	17,100	16,134	16,660	16,544	16,750	42	729,285	+ 18,034
Glossop (Urban Elec. Supply Co.)	122	125	118	125	118	118	121	115	12	1,380	− 67
Hastings and District	754	751	824	913	824	745	717	753	12	8,699	+ 103
Huddersfield Corporation	1,411	1,466	1,442	1,471	1,456	1,431	1,431	1,443	51	79,591	+ 3,269
Hull Corporation	2,284	2,317	2,322	2,353	2,431	2,428	2,407	2,350	51	125,595	+ 6,847
Ilford Corporation	406	410	414	449	374	370	391	388	51	22,684	− 1,049
Ilkeston Corporation	121	119	124	130	127	130	121	126	52	7,214	+ 423
Ipswich Corporation	311	309	302	320	311	292	296	290	51	19,586	− 1,141
Isle of Thanet	239	246	249	276	239	223	246	236	12	2,595	− 93
Keighley Corporation	135	137	148	134	154	133	145	142	38	5,954	+ 333
Kilmarnock Corporation	141	146	149	145	140	136	137	140	44	6,906	− 177
Lanarkshire	1,002	1,099	1,015	1,051	1,119	1,155	1,168	1,220	11	13,805	+ 2,432
Lancashire United	1,092	1,017	1,137	1,112	1,149	1,140	1,183	1,098	11	12,568	+ 992
Leeds City	5,956	6,032	5,952	6,173	5,990	5,976	6,090	5,938	51	328,476	+ 12,783
Leicester Corporation	2,019	2,142	2,068	2,090	2,094	2,114	2,072	1,900	12	24,301	+ 56
Leith Corporation	457	476	465	477	453	481	480	463	44½	22,904	+ 185
Leyton U. D. Council	818	852	844	915	828	805	830	802	51	50,554	
Liverpool Corporation	10,394	10,241	10,498	11,207	10,487	10,501	10,354	9,921	12	118,539	− 1,973
London County Council	27,386	27,731	27,590	29,023	30,195	29,954	30,598	...	50	1,550,805	+ 240,812
London General Omnibus	18,496	18,689	18,975	20,309	17,397	17,365	18,033	17,191	12	207,106	− 11,401
London Road Car	6,992	7,111	7,315	7,779	6,783	6,804	7,315	7,080	12	73,178	− 4,883
London United	5,235	5,165	5,386	5,703	5,243	5,192	5,431	5,243	12	59,445	− 438
Lowestoft Corporation	130	128	124	132	139	125	135	130	25	3,910	+ 161
Maidstone Corporation	...	...	...	...	142	137	144	140	51	6,942	—
Manchester Corporation	13,182	13,343	13,109	13,552	13,827	13,890	14,000	13,652	51	744,024	+ 48,916
Nelson Corporation	120	131	124	127	121	118	121	126	51½	7,201	− 45
Newcastle-on-Tyne Corporation	3,851	3,858	3,934	3,966	3,643	3,740	3,649	3,569	51	205,648	− 22
Newport (Mon.) Corporation	564	555	576	618	566	567	564	568	51	33,761	+ 2,035
Northampton Corporation	346	372	363	381	381	372	379	361	49½	21,502	− 203
Oldham Corporation	1,759	1,729	1,768	1,808	1,753	1,821	1,809	1,779	52	99,009	+ 6,266
Portsmouth Corporation	1,427	1,553	1,430	1,603	1,435	1,516	1,505	1,453	51	95,743	− 815
Preston Corporation	624	683	675	679	664	663	667	627	12	7,907	+ 136
Provincial	1,364	1,374	1,360	1,428	1,337	1,351	1,366	1,330	25	35,866	+ 1,145
Reading Corporation	520	536	562	579	536	543	536	520	50½	30,818	− 736
Rochdale Corporation	911	962	928	986	976	1,002	999	995	51	54,717	+ 2,776
Rossendale Valley	177	189	189	189	168	173	197	185	12	2,102	− 55
Rotherham Corporation	542	546	539	562	572	557	589	559	50½	30,588	+ 4,595
Salford Corporation	4,217	4,124	4,238	4,387	4,219	4,263	4,185	4,212	50	233,639	+ 6,685
Sheffield Corporation	5,309	5,263	5,331	5,487	5,123	5,379	5,365	5,118	52	287,295	+ 11,232
Southampton Corporation	773	827	816	823	916	890	939	854	50½	51,030	+ 3,342
Southend-on-Sea Corporation	232	252	252	257	263	257	269	263	51	19,310	+ 227
South Shields Corporation	468	476	475	514	479	494	481	469	51	28,390	+ 5,367
Sunderland Corporation	1,338	1,266	1,246	1,358	990	1,116	1,054	1,067	51	67,394	− 3,156
Swindon Corporation	134	149	139	152	135	136	137	136	—	—	—
Tyneside Tramways and Tramroads	376	397	386	411	339	323	338	338	12	3,895	− 310
Wallasey U. D. Council	722	714	720	825	732	757	741	699	50	41,729	+ 664
Walsall Corporation	395	390	410	420	516	515	599	514	12	5,920	+ 678
Walthamstow Corporation	390	440	446	494	479	484	500	498	51	29,758	+ 1,996
Warrington Corporation	340	353	357	372	366	373	365	341	51	19,157	+ 655
West Ham Corporation	2,066	2,169	2,087	2,199	2,124	2,045	2,116	2,036	51	115,710	+ 1,998
Wigan Corporation	1,149	1,162	1,155	1,215	1,252	1,269	1,285	1,204	51	64,065	+ 4,520
Wolverhampton Corporation	783	765	765	778	784	765	765	739	50	45,359	+ 569
Yorkshire (West Riding)	1,054	998	1,005	1,090	1,125	1,082	1,052	1,013	12	12,647	+ 686
FOREIGN TRAMWAYS.											
Anglo-Argentine	16,959	16,728	17,727	16,871	20,479	18,794	18,872	18,011	12	219,270	+ 28,341
Auckland (month)	10,088	...	...	...	11,997	...	...	...	8½	25,888	+ 3,582
Bombay	1,916	2,069	...	...	2,288	2,399	...	...	9	22,025	+ 4,523
Buenos Ayres and Belgrano	3,622	3,743	3,658	3,971	3,645	4,223	3,853	3,879	12	41,180	+ 540
B. Ayres Grand Nat. & New (Joint)	6,766	6,643	7,255	6,868	7,939	7,738	7,982	7,790	11	85,186	+ 11,955
Calcutta Rs.	49,149	49,320	47,298	43,078	46,832	50,586	48,002	45,602	12	602,398	− 37,668
Kalgoorlie (month)	3,516	...	...	...	3,417	...	...	...	9	7,055	− 238
Madras Rs.	14,849	(2 weeks)	16,829	(2 weeks)	16,303	(2 weeks)	21,149	(2 weeks)	10	96,918	+ 13,814
Perth (W.A.)	1,521	1,505	1,466	1,566	1,451	1,505	1,467	1,507	12	16,989	− 712
Rio de Janerio (month)	92,080	...	...	...	107,325	...	...	...	9	219,333	+ 31,063
Sao Paulo (month) $	171,844	...	...	...	186,689	...	...	...	9	378,420	+ 31,608
Singapore $	10,141	9,515	10,227	9,703	9,045	10,140	9,331	9,220	25	231,269	+ 7,755
ELECTRIC RAILWAYS.											
Baker Street and Waterloo	2,315	2,350	2,355	2,220	3,130	3,125	3,005	3,025	12	37,105	+ 8,794
Central London	6,286	6,404	6,376	6,129	6,132	6,121	6,031	6,033	12	73,497	− 2,963
Charing X Euston & Hampstead	...	...	...	...	3,180	3,170	3,135	3,160	12	37,760	—
City and South London	2,961	2,989	2,962	2,728	3,376	3,390	3,247	3,297	12	40,585	+ 4,089
Great Northern and City	1,873	1,855	1,830	1,811	1,838	1,817	1,672	1,652	12	21,771	− 960
Gt. North'rn, Piccadilly, & Brompton	3,910	3,995	4,150	3,885	5,510	5,430	5,285	5,430	12	64,720	+ 19,421
Liverpool Overhead	1,409	1,406	1,405	1,371	1,356	1,390	1,371	1,399	12	16,520	+ 48
Mersey	1,866	1,842	1,797	1,860	1,886	1,897	1,950	1,878	12	22,833	+ 1,033
Metropolitan	14,776	14,832	14,795	14,491	15,084	15,154	15,203	15,001	12	182,356	+ 1,956
Metropolitan District	7,832	8,102	8,431	7,858	9,065	9,155	9,004	8,777	12	107,279	+ 10,957

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THE ELECTRIC CONSTRUCTION CO.,

LIMITED.

ELECTRICAL ENGINEERS & CONTRACTORS.

MOTOR-GENERATORS.

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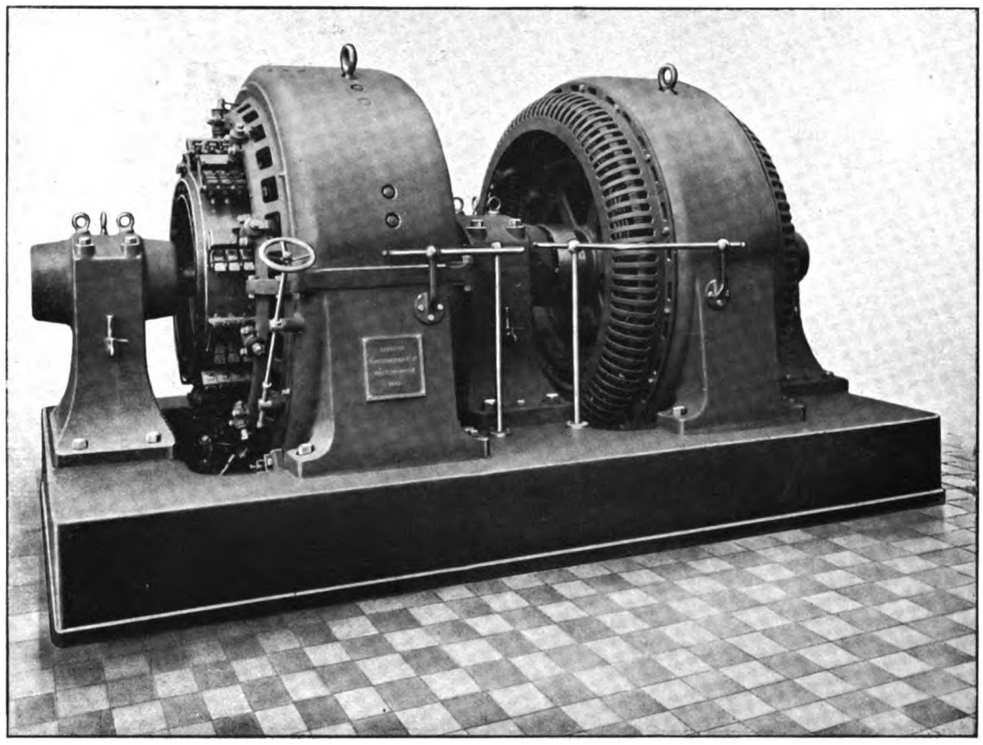

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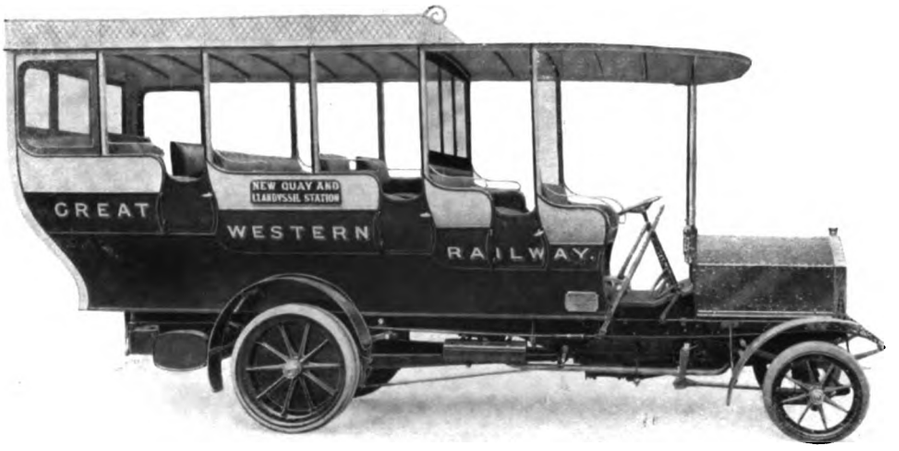

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AN OPINION "AFTER 16 MONTHS' CONTINUOUS RUNNING."

SILSDEN MOTOR OMNIBUS CO., LTD.,
nr. Keighley, Yorks., Nov. 13, 1907.

Dear Sirs,

With reference to the Motor Omnibus which you supplied to us in July, 1906, after 16 months' continuous running we are pleased to report to you that the good opinion we at first formed of your 'Bus has been more than justified by results, **and we congratulate ourselves in owning what we consider to be the best 'Bus on the market.** In consumption of Petrol and Oil she is remarkably economical. As to repairs your ledger will disclose that **our purchase of parts, &c., from you during the last six months have not exceeded £5,** which fact speaks volumes for the excellent workmanship of your Chassis. She requires a minimum amount of attention to keep her at concert pitch, and we can always depend on her carrying her complement of passengers (40) with ease up the long and steep gradients so numerous in this locality. We have nothing but unstinted praise for the manner in which your 'Bus has done its work on our country roads since July, 1906.—Yours faithfully,

p. pro **Silsden Motor Omnibus Co., Ltd.**
(Signed) M. P. CRYER, Secretary.

RYKNIELD MOTOR CO., LTD.,

BURTON-ON-TRENT.

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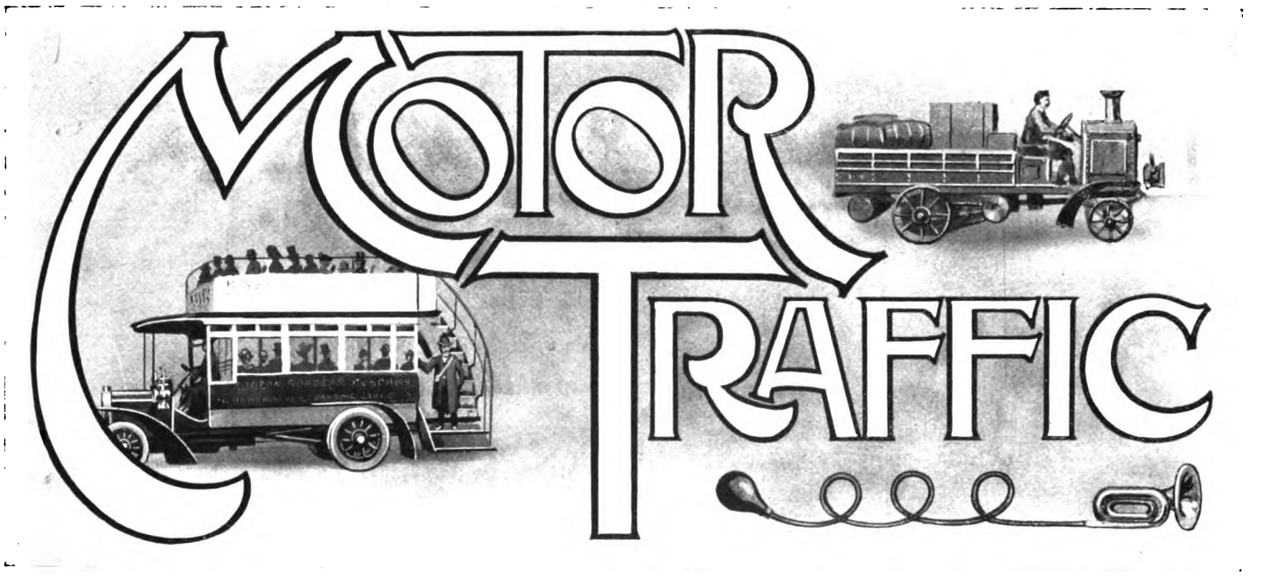

Both manufacturers and users of motor vehicles intended for business purposes are finding much to interest them in the report of the judges in the last commercial vehicle trials, an abstract of which is published in this issue. The report is so valuable that it seems a pity its publication has been so long delayed. However, now that it is available, it ought to be of service alike to makers and buyers, as it points out many details in construction in which improvements are desirable, and indicates the lines on which these improvements should proceed. This information is of real value, because it comes from independent experts, and the criticism, whether favourable or the reverse, is not of a character which is very frequently obtainable. The report, then, is valuable as far as it goes, but we are a little surprised that it does not go further. The organisation of the trials was elaborate, arrangements were carried out for ascertaining every possible detail of information, highly-skilled judges were engaged, and a great deal of money was spent. It was accordingly to be anticipated, especially as five months elapsed between the close of the trials and the issue of the report, that the motor traffic world would have been presented with a more detailed analysis and comparison of the various features of the mechanism of the competing vehicles. No doubt this analysis and comparison have been carried out by the judges, in order to arrive at the conclusions set out in their report. The document bears the stamp of being the result of much careful study of details, but probably many readers would be glad to have some of these details, as well as the important conclusions which are drawn from them.

The certificates granted in respect of each vehicle state the distance run, the kind and quantity of fuel used, the quantity of lubricants, the weight of the load carried, and the time occupied by stoppages other than those caused by traffic or which were compulsory. Appended are the general features for which the vehicle was "highly commended" or "commended." Not much information as to features of machinery can be got out of these matters. It may be noted, however, that, while the general report is necessarily largely devoted to pointing out directions in which improvements are desirable, the certificates show the features on which each machine was regarded as commendable. These certificates, however, should have contained a heading stating the quantity of fuel consumed per ton-mile. As the figures are given—namely, miles per gallon (or, in case of coal fuel, pounds per mile)—no comparison can be made between the different vehicles in the matter of fuel consumption, until the inquirer goes to the trouble of working out the amount per ton-mile. Miles per gallon for a light van cannot be compared with miles per gallon for a lorry or omnibus (many of the chassis were suitable for omnibuses), weighing four or five tons.

One important feature in connection with the trials which has not been emphasised is the condition of the machines at the close of the runs. The engines and mechanism were in each case opened and examined by the judges after the trials were over, and the result of this inspection is in some cases indicated where vehicles are commended or highly commended for their condition at the finish. Owing to the fact that so many features were taken into account, it happens that some vehicles standing high in the awards list have no mention of condition at the finish, while others which did not gain prizes are warmly commended in this respect. This matter of condition at the close of the trials is a vital one for purchasers, because any gearing or other mechanism which wears out rapidly will more than counterbalance a good many other excellencies. To a certain extent analogous remarks apply to such items as workmanship, freedom from smoke, and ease of manipulation.

Some excitement was caused in financial circles—and to a less extent among manufacturers and operators of motor 'buses—during March by the proposals for the amalgamation of the London General and the Vanguard Omnibus Companies on the one hand, and of the London Road Car and the Great Eastern London Omnibus Companies on the other. Objections have been raised to the terms in the former case, but should the combinations be finally accomplished, nine-tenths of the motor 'buses in London will be owned by the two amalgamated companies. Whatever other results may be attained it is apparent that a greal deal of wasteful competition will be eliminated. The number of motor vehicles owned by the four companies is over 900, while the General and the Road Car Companies have also a large number of horse omnibuses. The Great Eastern Company appears to be in a good financial position, and the Vanguard Company reports having made a profit of some £11,000 in its first nine months, but the two big old companies are working at

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a heavy loss. The capital of the two latter is very large, and they have many horse 'buses yet to write off. Only most conservative financial arrangements can lead to a hope for reasonable dividends on the combined concerns.

The second commercial motor vehicle exhibition, which was opened as these pages were about to go to press, is a highly interesting and important show for all concerned in the motor vehicle as adapted for any commercial or industrial purpose. After the experience of the first show held last year, the promoters were fully justified in organising a second, and it seems probable that such exhibitions will go on from year to year with increasing success. Though the vast interior at Olympia, London, is not quite so completely filled as it was twelve months ago, the exhibits are of even more importance than they were then, and in detail they reveal many advances which have been made, as well as some striking new designs. Representatives may be found of all the classes of vehicles which ran in the last commercial vehicle trials, from the heaviest to the lightest, as well as of several other classes, including omnibuses and cabs which did not figure in the trials at all. The show reveals the magnitude of the industry, and enables intending buyers to make comparison of all the different types. To both parties it should prove of great value. In a future issue we hope to deal in some detail with the kinds of motor vehicles shown in which readers of this journal are most interested.

SOME EXPORT ORDERS.

Milnes-Diamler, Limited, have recently shipped two single-deck omnibuses to British Guiana for service between New Amsterdam and Skeldon. They are designed to carry mails as well as passengers. The chassis are of the well-known Milnes-Diamler 22 H.P. type, and

the bodies, which were built by C. Dodson, Limited, are of a special design, shown in the accompanying illustration. All the woodwork is in teak. Milnes-Daimler have also despatched 14 of their standard 3-ton chassis to the Federated Malay States, to the order of the Crown Agents.

A North East Coast Service. It is announced that the North Eastern Railway Company are making arrangements to extend their East Northumberland motor-'bus service to Blyth on the coast. The vehicles will open up communication between Tyneside towns and a fine beach and golf links to which access hitherto has not been convenient. The service is expected to begin during the coming summer, and considerable development of the locality may follow.

PRODUCER GAS FOR AUTOMOBILES.

In view of the great fuel economy likely to be obtained from the use of producer gas for automobile vehicles, various attempts are being made to design a suitable producer plant for carrying on the car. A great deal of promise attaches to the arrangement devised by the Automobile Gas Producer Syndicate, of 93, Hope Street, Glasgow. The firm inform us that recent trials have been of a very satisfactory kind. The vehicle employed is a char-a-banc, and the fuel consumption has

averaged 1⅛ lb. of anthracite coal per ton-mile. The weight of the vehicle and passengers as run on one trial was about 5 tons. A non-stop run of 35 miles through traffic was the equivalent of 173 ton-miles, and the coal consumption was 189 lb. The corresponding consumption of petrol, when that fuel was used, was a gallon for 21¼ ton-miles. The anthracite cost 20s. per ton, and the petrol 1s. 2d. per gallon. This gives a comparative cost per ton-mile of ·12d. for anthracite, and ·67d. for petrol. These results were obtained with an engine designed for working with petrol, so that it is probable even greater economy may be got with an engine made for working with producer gas.

In the case of another trial, over 40 miles, including both town streets and heavy country roads, the weight of vehicle and passengers was 4 tons 18 cwt. The anthracite consumed was 145 lb., giving a consumption of ·74 lb. per ton-mile, being thus a great improvement on previous records. A cheaper kind of anthracite, costing 15s. a ton, was used, so that the fuel for the run cost about 1s., or ·06d. per ton-mile. The average speed of the vehicle was over ten miles an hour

The car employed is shown in the accompanying illustration. The engine, designed for using petrol, is rated at 40 H.P. with that fuel, and gives about 30 H.P. when using producer gas. The compression of the gas in the cylinder is 115 lb. per square inch, and with this arrangement either low-tension magneto or accumulator ignition is suitable. The power transmission to the road wheels presents no novelty. The gas producer and the fuel hopper are placed between the engine and the dash-board, occupying only 18 in. of the length of the vehicle. The grate area is about one square foot, and water is sprayed through a nozzle in the centre of the grid on which the coal rests. The hopper above has three openings on the top, closed by gas-tight covers, and the coal capacity is over 5 cwt. Two of the openings are for feeding in coal, while the centre one provides for three perforated dust-intercepting trays. The gas, after passing through these, is led to a coke scrubber under the frame, and thence by another pipe to a mixing chamber alongside the hopper. Here a regulated quantity of air is admitted, and the mixture passes on to the engine throttle-valve. The blast for the producer is obtained from a rotary blower, driven from the engine. The blower can be worked by hand for starting up. The water-spray, which is used in the producer instead of steam, is forced from a tank by a rotary pump, which is under the nicest regulation. The control of the whole apparatus by the driver is carried out by one lever for the ignition, one for the water injection, and one for the engine throttle, and by an air cock for regulating the air supply to the mixer. To start up the vehicle from cold takes about eight minutes. This vehicle is striking evidence of the truth of the contention of many engineers that there are great possibilities in suction gas producer plant both for road and railway vehicles.

Brighton is now included among the towns served by taximeter motor cabs. A start was made in the middle of March.

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MOTOR TRAFFIC.

COMMERCIAL MOTOR-VEHICLE EXHIBITION.

The second International Commercial Motor-Vehicle and Motor-Boat Exhibition was opened at Olympia, Kensington, on March 27. The Exhibition, which is organised by the Society of Motor Manufacturers and Traders, is under the patronage of the Prince of Wales, and remains open till April 4.

The company present at the inaugural luncheon of the Exhibition was representative of the leading commercial interests Mr. E. Manville, President of the Society of Motor Manufacturers and Traders, was in the chair. Municipal bodies were represented by the Lord Mayor of London, the Lord Mayors of Newcastle and Leeds. The railway companies, who are extensive users of motor vehicles, were represented by Sir H. Oakley (G.N.R.), Mr. S. E. Gooday (G.E.R.), Mr. C. J. Owens (L. and S.W.R.), and Mr. Cunningham (Central London).

In the vehicle section are many novelties which have never been previously exhibited, and are a distinct departure. Great improvements are shown in motor omnibuses and motor cabs, whilst vans for tradesmen show great advance. The exhibitors are from every part of the country and several from the Continent. Glasgow, Birmingham, Coventry, Nottingham, Peterborough, Lincoln, Luton, Preston, Sheffield, Leeds, Dartford, Windsor, Paisley, Burton-on-Trent, Bristol, and, of course, London are all well represented by the leading firms in the motor trade, whilst Southampton, Norwich, Lowestoft, and Chiswick are the principal contributors of motor boats. The foreign contingent includes the Darracq-Serpollet (whose steam omnibuses are now a feature of the London streets), De Dion Bouton, Fiat, De Dietrich, and others. A notable feature is the evidence of the great expansion of the tyre trade in the tyre and accessories section, which also contains many interesting exhibits of carburettors suitable for the use of paraffin and low grade oils for motor boats and heavy vehicles. In a subsequent issue we hope to deal with some of the leading exhibits.

On Friday last the Lord Mayor of London, Sir John Bell, declared the Exhibition open. In doing so he said that he looked forward with intense interest to the future of the industry, as it was evident that the self-propelled vehicle would have an incalculable influence in the history of the world.

At the lunch which followed, the Lord Mayor, in proposing a toast of prosperity to the Exhibition, said that he remembered the first Exhibition of all kinds of motor cars, and was reminded by the present Exhibition of the enormous strides which had been made since that time. He hoped that future improvements in the commercial section would include the construction of the quiet motor omnibus. If they could only succeed in making motor omnibuses quiet, less offensive, and a little cheaper, they would have effected an enormous improvement. That those omnibuses had come to stay there could be no doubt. He believed that they would outlive the tramcar, and that the time would come when it would be unnecessary to make the roads into tram-tracks. He had noticed with pleasure the large number of uses to which the motor could be adapted. Taxi-cabs had conferred a great boon on the people; but those vehicles would be still more useful if inventors could only devise some kind of mechanism which would ensure the correct registration of fares. As for the ordinary commercial vehicles, the Corporation of London had used them for some time past. The only thing against them was that they were expensive to work. That and other difficulties would, he was sure, be overcome as time advanced. He joined with motorists in the hope that the Government would not seek to check and paralyse the industry by taxation.

Mr. Manville, in responding, said that in March last year they had held the first exhibition entirely devoted to commercial vehicles, and

View of the Exhibition.

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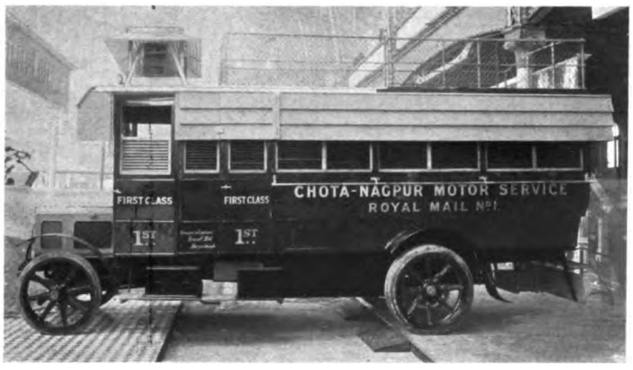
so pronounced was its success that it had justified the holding of this second exhibition, which showed the marked progress that had been made during the year. In September the society had the co-operation of the Royal Automobile Club in the organistion of the very successful van trials which were then held. It was probable that never before had so complete a revolution been effected in the habits of the people as had been effected by the introduction of the motor vehicle. It was on the commercial side that they must look for the continued expansion of their industry. He was voicing the sentiments of the society when he said that no further burden ought to be laid on the motor system of transport. They believed it to be against public policy that methods of locomotion should be taxed.

Speeches were also delivered by Sir J. H. A. Macdonald, Mr. H. G. Burford, and others.

MOTOR 'BUSES FOR INDIA.

A distinctly novel type of motor 'bus will shortly be put into service in Bengal by the Chota-Nagpore Motor Service Company, Limited, of Hazaribagh. The chassis are of the Darracq-Serpollet well-known standard 30-40 H.P. type, with a few minor alterations. The bodies, built by Messrs. Liversedge and Son, have been specially designed by Mr. Ernest C. Hill, the manager of the Chota-Nagpore Motor Service Company.

The introduction of this motor service indicates a most important advance in transport facilities in rural India and, if successful, is likely to be followed by a number of similar undertakings.



Darracq-Serpollet 'Bus for India.

Hazaribagh is a very pretty health resort, raised on a plateau about 2,000 ft. above sea-level, and situated 255 miles to the North West of Calcutta, in the sub-district of the same name. The population of the town is 16,000, and the rural population along the 'bus service route about 58,000. The railway station, Hazaribagh Road, to which the 'buses will run, is distant 41 miles, at the 214th milestone from Calcutta on the recently-completed Grand Chord section of the East Indian Railway. Previous to the completion of the Grand Chord line, at the end of 1906, the nearest railway station was 72 miles from Hazaribagh. Up to the present time the only mode of passenger transport has been by means of the well-known bullock cart or the native "push-push," a kind of box mounted on two wheels and propelled by five coolies at an average speed of three miles an hour.

It is a generally accepted fact that Hazaribagh would have become an exceedingly popular health resort for the lower Provinces had it been more accessible, and it is in this direction that the new motor company expect to reap a reward for their enterprise, for instead of the journey between Hazaribagh and Hazaribagh Road Station occupying some 15 hours as at present, the Darracq-Serpollet steam 'buses will cover the distance in 3½ hours.

It is not intended to confine the service to passenger traffic alone, for while the 'buses will carry the mail it is also intended to run a heavy goods service into the outlying districts where the existing methods of transport are equally primitive.

In designing the 'buses Mr. Hill had to exercise a considerable amount of ingenuity, for he had not only to meet the requirements of a tropical climate, but to provide as much comfort as possible in a limited space, as local conditions and customs have made it necessary for each 'bus to contain three distinct compartments.

The Darracq-Serpollet chassis was recently described in these pages, the only alteration from the standard type being in consequence of the extra size of the bodies, and as it will be necessary for the vehicles to do the double journey of 82 miles without replenishing either the paraffin or water tanks these are much larger than usual. The paraffin tank occupies the full width of the chassis, under the driver's seat, while the water tank is in the position usually allocated to the radiator in close proximity to the generator. The radiator is placed on the roof, and while exposed to the air is protected by a double louvered covering which will keep off the sun's rays, and yet permit of the heat passing out. D. J Smith's thermo-couple gauge for registering degrees of superheat and also a grodometer are provided. Morse silent chains are fitted; these are of the double engagement type and of the most recent design. Iron chain guards are also fitted. Iron trays are provided which completely encase the engine, generator, etc., thus ensuring freedom from dust troubles, a most important point in view of the nature of the country through which the 'buses will travel. The wheels are of cast steel, and fitted with specially moulded tyres manufactured by the Shrewsbury and Challiner Tyre Company of Manchester. The extension to the frame of the standard chassis is 3 ft. 6 in. long, and is so arranged that the side pieces can be removed and the end member placed in position, so as to form the standard frame, thus facilitating the shipment of the vehicles.

The bodies are of two types. They are unique in many respects, and represent an excellent example of first-class workmanship, combined with exceptional strength. They are built of ash specially treated to resist the depredations of the white ant; the panelling is of mahogany. All supports are well stayed with iron, the complete body as a matter of fact being ironed wherever possible. As it is anticipated that a considerable quantity of luggage, besides the mail, will have to be carried, ample arrangements have been made for its accommodation on the roof, which is of great strength. A net rail, 2 feet high, with adjustable cross pieces and a sliding net rail gate are provided. An adjustable iron ladder gives access to the roof.

As the service will be maintained during all seasons, and as a temperature of 150 deg. Fah. has to be considered, naturally the question of ventilation and shade has claimed special attention. Feather edge board sunshades are fitted on all sides: these are well stayed with iron, and stand out some four inches from the body, thus leaving a clear air space all round. Below these are Venetian shutters, which are worked from above and can be fixed in any position. Ventilators are also fitted beneath the seats, and in the bottom of the partition dividing the driver's compartment from the interior of the vehicle. It will thus be seen that a free passage of air is obtained both above and below the seats. Type A, of which we give an illustration, is arranged for three classes, and gives accommodation for 5 first-class, 8 second-class, and 24 third-class passengers. This is arranged by dividing the interior into equal portions, the rear forming the third-class compartment, and the fore part being sub-divided, thus forming the first and second-class compartments. In the first-class, sleeping accommodation is also arranged for. The upholstery is in Morocco leather. An extending seat (which forms the couch for sleeping), a folding seat, a folding table, a mirror, and a luggage and hat rack are provided. There are three frosted glass panels in the partition. In the second-class compartment the seating is in rattan, and there are a folding table and hat rack. The third-class compartment is arranged with four rows of longitudinal seats and two wood-slat doors at the back.

In the second type of 'bus accommodation is given for 40 third-class passengers and two second-class passengers, the latter being placed beside the driver. The interior of this vehicle is arranged in a similar manner to the rear part of the three-compartment 'bus. Electric bells are fitted, and each compartment is well lit with the Lewis Lighting Company's system of acetylene gas. The gas generator is suspended at the back of the chassis. Rain curtains are provided, and a waterproof cover over the luggage rails. The driver's compartment is enclosed, and has a hinged glass screen in front and a door on either side. A folding step is fitted at the back of the 'bus, while ample tool boxes are also provided.

Mr. Hill, to whom we are indebted for the foregoing particulars, informs us that the Chota-Nagpore Motor Service Company have been appointed agents for the Darracq-Serpollet chassis in India, Burmah, and Ceylon, and that they will also represent Messrs. Liversedge and Sons for car bodies and The Shrewsbury and Challiner Company for tyres.

DURHAM AND DISTRICT MOTOR 'BUS COMPANY.—A final meeting of the shareholders of this company was held in Durham on March 20, when Mr. G. A. Carpenter, the liquidator, presented a statement of accounts, showing that it will be possible to pay a dividend of 6s. 4½d. in the pound to the creditors of the company on claims amounting to £798, shareholders receiving no return. The accounts were adopted.

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MOTOR TRAFFIC.

THE COMMERCIAL VEHICLE TRIALS.

Merits and Defects.

The Royal Automobile Club have now published the report of the judges on the commercial motor vehicle trials which took place from September 9 to October 12 last year. The awards of the judges were made known shortly after the close of the event, but there are various interesting matters in the detailed report, which has been issued after considerable delay. The volume contains, besides the report, tabulated particulars and also illustrations of the various types of wheels used on the vehicles, brief descriptions of each vehicle, the points for which it is commended, the regulations connected with the trials, and all collateral official information which has been previously published, so as to make the book a complete work of reference on all points connected with the trials. Fifty-six vehicles started in the trials, of which 50 completed the course. It may be recalled that they were divided into seven classes, according to weight, and over 20 prizes were awarded, as reported at the time. The following is an abstract of the judges' report:

In submitting the following detailed remarks, the judges would draw attention to the fact that, although the trials were the largest and most comprehensive ever held, and possibly may have reached the maximum reasonable limit in extent, the total distance covered was only sufficient to bring out radical faults and weaknesses, and to enable the following general conclusions to be drawn:

For useful loads exceeding three tons the tractor is the most economical for general haulage. Where speeds are required which are too high for the tractor, the internal combustion engine lorry mounted on rubber tyres becomes a necessity.

The steam lorry (Class F), although it possesses the disadvantage of large axle weights, can with advantage be employed where high speeds are not required, and where the loads have to be delivered at quays or places where the tractor with its trailer could not be so readily manœuvred.

The petrol lorries submitted were capable of speeds on the road which were excessive, and should not be tolerated. A general reduction of gear ratios seems a necessity, and would result in greater economy, inappreciable loss in average speed on the road, and less wear and tear of both road and vehicle. The cost of upkeep increases very rapidly with increase of road speed, and, although the true economic speed has not yet been determined, high maximum road speeds should be avoided as a general rule in commercial vehicles.

The reliability and regularity of running throughout were remarkable. The condition of the majority of the vehicles after the trials was on the whole satisfactory. The amount of wear on the parts was in many cases inappreciable; but some manufacturers have still much to learn as regards design and the selection of material, before they arrive at a vehicle showing low cost of maintenance and durability.

A striking feature in the trials was the successful use of india-rubber tyres carrying heavy loads up to five tons. About 90 per cent. of the vehicles (excluding tractors) had rubber tyres, which gave on the whole remarkably little trouble, notwithstanding the high temperature recorded by the thermometer on several days of the trial.

Only two types of vehicles were fitted with wheels made entirely of steel, although a third employed a wheel with steel spokes. The cast steel wheel of to-day is practically imperishable if it be shod with rubber tires, but the use of a built-up wooden wheel is an important factor in prolonging the life of a vehicle and keeping down the repair bill.

The wheels in Class H (that is, the tractor class) have an average diameter of about 30 per cent. greater than those in classes C, D, and E (that is, the heavier motor wagon classes). The destructive effect on the road is greatly diminished by a small increase in the size of the wheel, and the vehicle itself runs more smoothly. The difficulties connected with weight, cost, and material, consequent on increase of diameter, must be grappled with, and it is recommended that, both for the sake of the vehicles themselves on the one hand, and of the roads on the other, the diameter of wheels should be increased and kept as large as compatible with practical requirements.

There would appear to be a future for a type of vehicle suited for delivery work in the country in cases where speed on the road is of secondary importance, where capital outlay and running costs are required to be reduced to the minimum, and where the loads to be carried would not exceed three tons. The majority of petrol lorries, being a very high-class engineering product, do not fulfil these conditions, and manufacturers might well turn their attention to a cheaper and slower class of vehicle, an excellent example of which was submitted.

The trials have demonstrated that petroleum fuel can be successfully used for internal combustion engined lorries in lieu of petrol (petroleum spirit); the relative price of these fuels renders it desirable that more general attention should be paid by manufacturers to the possibilities of less volatile fuels, which possess the additional advantage of greater safety in storage and handling.

It is regretted that no tractor fitted with an internal combustion engine was entered in the trials. The steam vehicle as at present constructed requires to pick up water at frequent intervals, generally not exceeding 20 to 30 miles. The internal combustion engine, or a steam vehicle fitted with a condenser, is in some countries a necessity, as its use enables the radius of action of the vehicle to be increased to distances exceeding even 150 miles, the limit depending upon the capacity of the fuel and water tanks.

As regards the details of construction and design of the vehicles that competed in the trials, it was evident that a very great improvement all round has been made during the past few years. This was notably the case in the matter of wheels. A marked improvement was generally apparent in the attention paid to details such as wiring, accessibility of nuts, bolts, etc., and ease of removal of those parts which require most attention; there were, however, a few vehicles in which such points had been totally neglected.

A few manufacturers had carefully studied the relative positions of the driver and the operating levers, pedals, steering wheel, etc., but in many cases the pedals were in such a position that only with the greatest discomfort could they be reached by a driver of average build. The practice of having on the "dash" engine-control levers, hand pumps, oil taps, etc., which require frequent actuation, should be discontinued.

As regards brakes, brake surfaces should be increased and provision made to keep them free from grease. Compensation of the back brakes should be arranged for without employing wire cable or the large number of pinned connections used in some of the vehicles. Both foot and hand brakes should be provided with simple means of adjustment without the removal of any part, and the renewal of blocks or shoes with a minimum of labour and expense is a desideratum. No single vehicle can be considered ideal in these respects.

It was noticed that the overhang of many of the bodies was excessive. This practice, probably followed to gain adhesion, entails an excess of weight being carried on the back axle, causing damage to roads and undesirable stresses in the vehicle.

More attention is required in the majority of cases as regards the accessibility of the machinery under the platform; in many cases it was impossible to gain access to those parts without disturbing the load.

A system of control whereby the speed of the engine can be governed by the speed of the road wheels is suggested as worthy of consideration.

Stauffer grease-cups were fitted indiscriminately and in a most lavish manner to parts requiring but little lubrication; they were lost or broken to a large extent. The proper lubrication of such parts should be orignally provided for by the designer, and not affected by subsequent addition of projecting pieces. The use of syphon oil-boxes is worthy of consideration. Though it has been conclusively proved that the application of forced lubrication to the engines conduces to lower cost of running and of maintenance, few of the competing vehicles were so fitted.

The commutators in the primary circuits, and the distributors in the secondary circuits were poor in design, and insufficiently supported in their bearings, and unsuited for use for commercial work.

Pumps for water circulation were noticed (*a*) of insufficient size; (*b*) with bearings unduly overhung; (*c*) bearings at one end of the spindle only. The ideal vehicle would not have a pump at all, and it was proved in the trials that this was quite compatible with efficient operation.

The connections between the gear-changing lever and the gear box were in most vehicles of a wholly inadequate character; they should be such that the full meshing of the teeth of the gear wheels is ensured without frequent adjustment.

The excessive wear in some of the jointed couplings transmitting the drive was due partly to unsuitable material, but mainly to the driving shafts not being designed to be in a line when the vehicle is fully loaded.

The attachment of suspension springs in some vehicles was such as to set up torsional stresses in the frames; the shackling of the rear springs at the forward end in place of the rear end is worthy of further investigation.

With reference to the tractors a better spring suspension is desirable, and a properly compensated drive to allow free movement on the springs is necessary; the practice of allowing variation of pitch in the gear drive to give this compensation is not desirable.

It has been contended that the legal limit of tare weight is responsible

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MOTOR TRAFFIC.

for lack of improvement in this direction, but much weight can be saved by the employment of higher-class material, and manufacturers are referred to the specification for material used in the construction of railway rolling stock issued by the British Engineering Standards Committee. The very important point of the mode of attachment of the drawbar of the tractors was in no case perfectly satisfactory; it should have a bearing right round the horn-blocks and should not bear on the back axle. These bars should not be anywhere riveted to the rear tank, which should itself be strutted to take side stresses imposed by the drawbar when the pull from the wagon is at an angle to the direction of movement of the tractor.

In conclusion, it may be said that the commercial vehicle trials have fully justified the heavy expenditure of time and money devoted to them, and it is believed that the opportunity given to the entrants to study the behaviour of their own and other competitors' vehicles under the strict conditions of the trials will result in improved design and in benefit, not only to themselves, but to the ever-increasing number of those to whom facilities for mechanical transport on common roads are of importance.

The tabulated particulars, appended to the report, giving detailed results and points of merit for each vehicle are of much value, but are very voluminous. We append an abstract in regard to some of the machines in which special interest may be taken by readers.

CLASS A.—NET LOAD CARRIED, 10 CWT.

A-2. De Dion Bouton 9 H.P. box van; weight unladen, 19½ cwt.; price, £325; awarded silver medal; ran 1,599 miles; time occupied by all stoppages other than those caused by traffic or which were compulsory, 4 h. 38 m.; miles per gallon of petrol, 21·08; highly commended for adequacy of platform area, ease of manipulation, finish and workmanship, freedom from smoke, steering gear; commended for cost per net ton mile.—De Dion Bouton (1907) Limited, London.

A-6. Mann and Overton 10-12 H.P. Unic van; weight unladen, 16¾ cwt.; price, £315; awarded gold medal; ran 1,596 miles; time of stoppages, 1 h. 18 m.; miles per gallon of petrol, 22·25; highly commended for accessibility, adequacy of platform area, condition after trial, cleanliness, ease of manipulation, finish and workmanship, hill climbing, quiet running, springing, cost per net ton mile.—Mann and Overton, Limited, London.

CLASS B.—NET LOAD CARRIED, 20 CWT.

B-9. Lacre 16 H.P. box van; weight unladen, 1 ton 12 cwt.; price, £475; awarded gold medal; ran 1,348 miles; time of stoppages, 3 h. 11 m.; miles per gallon of petrol, 14·9; highly commended for adequacy of platform area, brakes, condition after trial, ease of manipulation, finish and workmanship, freedom from smoke, general appearance, hill climbing, quiet running, springing, steering gear; commended for cleanliness, cost per net ton mile.—Lacre Motor Car Company, Limited, London.

B-12 Lacre van, particulars as B-9; awarded gold medal; ran 1,360 miles; time of stoppages, nil; miles per gallon of petrol, 16·28; highly commended for adequacy of platform area, brakes, ease of manipulation, finish and workmanship, general appearance, hill climbing, springing, steering gear; commended for condition after trial, cleanliness, cost per net ton-mile. Lacre Motor Car Company, Limited, London.

CLASS C.—NET LOAD CARRIED, 30 CWT.

C-13. Halley 18-20 H.P. van; weight unladen, 2 tons 1 cwt.; price £490; awarded silver medal and Worby-Beaumont prize; ran 1,257 miles; time of stoppages, nil; miles per gallon of petrol, 9·44; highly commended for adequacy of platform area, brakes, condition after trial, cleanliness, ease of manipulation, finish and workmanship, freedom from smoke, hill climbing; commended for steering gear, cost per net ton-mile.—Halley's Industrial Motors, Limited, Yoker, Glasgow.

C-16. Darracq-Serpollet, 20-25 H.P. delivery van with canvas tilt; weight unladen, 2 tons 15 cwt.; price £790; ran 1,247 miles; time of stoppages, 23 m.; miles per gallon of paraffin, 4·82; highly commended for condition after trial, ease of manipulation, finish and workmanship, hill climbing, quiet running, springing, steering gear. —Darracq-Serpollet Omnibus Company, Limited, London.

C-19. Thorneycroft 24 H.P. lorry with rim sides; weight, unladen, 1 ton 19¼ cwt.; price, £595; awarded gold medal and Army Council diploma; ran 1,247 miles; time of stoppages, nil; miles per gallon of paraffin, 9·3; highly commended for accessibility, brakes, condition after trial, finish and workmanship, freedom from smoke, hill climbing, springing, cost per net ton-mile; commended for steering gear.—J. I. Thorneycroft and Company, Limited, Basingstoke.

CLASS D.—NET LOAD CARRIED, 40 CWT.

D-20. Halley 20 H.P. platform lorry; weight unladen, 2 tons 0 cwt. 1 qr.; price, £510; awarded gold medal; ran 1,144 miles; time of stoppages, 1 h. 15 m.; miles per gallon of petrol, 9·91; highly commended for brakes, ease of manipulation, freedom from smoke, general appearance, steering gear, cost per net ton-mile; commended for accessibility, cleanliness, finish and workmanship. —Halley's Industrial Motors, Limited, Yoker, Glasgow.

D-24. Milnes-Daimler 22 H.P. lorry, with canopy over driver; weight unladen, 3 tons 3¾ cwts.; price, £735; awarded gold medal; ran, 1,139 miles; time of stoppages, 1 h. 10 m.; miles per gallon of petrol, 8·32; highly commended for condition after trial, ease of manipulation, finish and workmanship, freedom from smoke, general appearance, quiet running, springing, steering gear; commended for accessibility. —Milnes-Daimler, Limited, London.

CLASS E.—NET LOAD CARRIED, 60 CWT.

E-30. Hallford 30-38 H.P. lorry; weight unladen, 3 tons 3¼ cwt.; price, £750; awarded gold medal and Royal Automobile Club diploma; ran 927 miles; time of stoppages, 3 h. 44 m.; miles per gallon of petrol, 7·23; highly commended for accessibility, adequacy of platform area, brakes, finish and workmanship, freedom from smoke, general appearance, hill climbing, quiet running, springing; commended for condition after trial, cleanliness, cost per net ton-mile. —J. & E. Hall, Limited, Dartford, Kent.

E-34. Darracq-Serpollet 30-40 H.P. lorry with detachable sides; weight unladen, 3 tons 9¾ cwt.; price, £885; awarded silver medal; ran 927 miles; time of stoppages, 2 h. 6 m.; miles per gallon of paraffin, 3·11; highly commended for adequacy of platform area, ease of manipulation, hill climbing, quiet running, springing, steering gear; commended for brakes, condition after trial, freedom from smoke.—Darracq-Serpollet Omnibus Company, Limited, London

E-40. Maudslay 30-40 H.P. miller's dray; weight unladen, 3 tons 17½ cwt.; price, £860; awarded gold medal and Army Council diploma; ran 927 miles; time of stoppages, 30 m.; miles per gallon of petrol, 9·05; highly commended for accessibility, ease of manipulation, finish and workmanship, freedom from smoke, hill climbing, quiet running, steering gear; commended for condition after trial, cleanliness, cost per net ton-mile.—Maudslay Motor Company, Limited, Coventry.

E-43. Commercial Cars 33 H.P. lorry with detachable sides and tail board; weight unladen, 3 tons 17½ cwt.; price £750; awarded silver medal; ran 941 miles; time of stoppages, 47 m.; miles per gallon of petrol, 5·92; highly commended for brakes, condition after trial, ease of manipulation, freedom from smoke, general appearance, springing, steering gear; commended for finish and workmanship.—Commercial Cars, Limited, Luton.

E-45. Thornycroft 30 H.P. lorry with rim sides; weight unladen, 3 tons 4¾ cwt. price, £760; awarded silver medal; ran 927 miles; time of stoppages, nil; miles per gallon of petrol, 6·63; highly commended for condition after trial, finish and workmanship, freedom from smoke, hill climbing; commended for accessibility, brakes, cost per net ton mile.—John I. Thornycroft and Company, Limited, Basingstone.

E-47. Ryknield 40-50 H.P. covered van; weight unladen, 4 tons 2¾ cwt.; price, £785; ran 927 miles; time of stoppages, 51 m.; miles per gallon of petrol, 5·96; highly commended for adequacy of platform area, adhesion, freedom from smoke, hill climbing, springing, steering gear; commended for accessibility brakes. —Ryknield Motor Company, Limited, Burton-on-Trent.

CLASS F.—NET LOAD CARRIED, 100 CWT.

F-50. Savage 35 H.P. flat platform lorry; weight unladen, 5 tons 3½ cwt.; price, £550; awarded gold medal; ran 688 miles; time of stoppages, 5 h. 47 m.; pounds of coal per mile, 12·16; highly commended for accessibility, adhesion, condition after trial, ease of manipulation, finish, and workmanship, freedom from smoke, quiet running, steering gear; commended for cleanliness, cost per net ton-mile. —Savage Brothers, Limited, King's Lynn.

F-53. Yorkshire 35 H.P. lorry with flat wooden body; weight unladen, 4 tons 19 cwt.; price, £475; awarded gold medal; ran 688 miles; time of stoppages, 9 h. 43 m.; pounds of coal per mile, 18·25; highly commended for adequacy of platform area, adhesion, finish and workmanship, freedom from smoke, general appearance, hill climbing, steering gear, cost per net ton mile; commended for accessibility, brakes, condition after trial.—Yorkshire Patent Steam Wagon Company, Hunslet, Leeds.

F-55. Ryknield 40-50 H.P. open brewer's lorry; weight unladen, 4 tons 6¾ cwts.; price, £750; ran 714 miles; time of stoppages, 3 h. 49 m.; miles per gallon of petrol and Brit. turps, 4·25; highly commended for adhesion, finish and workmanship, general appearance, steering gear; commended for brakes, cost per net ton-mile.—Ryknield Motor Company, Limited, Burton-on-Trent.

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MOTOR TRAFFIC.

PROPOSED OMNIBUS COMPANIES' AMALGAMATIONS.

During the past month two great amalgamation schemes were put forward, affecting the three largest omnibus companies in London and one of the smaller ones. The first project is for the fusion of the London General Omnibus Company with the Vanguard Motor Omnibus Company, while the second seeks to combine the London Road Car Company and the Great Eastern London Motor Omnibus Company.

In regard to the first of these, circulars were issued in the second week in March, from which it appeared that the directors proposed that everything belonging to each company should be valued, and that after deducting the debts of each company the balances would be joined together to form the capitalisation of the combined company. The debentures of the Vanguard Company would be exchanged for "C" debentures of the London General Company, ranking behind the first and "B" debentures. As previously announced, the latest returns issued by the General Company showed that they continued to incur heavy loss on working. The circular sent out by the directors of the Vanguard Company stated that for the nine months ended December 31 last, that company had made a profit, after allowing for all expenses, depreciation, and debenture interest, of £11,000. The object of the amalgamation was to put an end to disastrous competition, and to effect economies and improvements. Various arrangements as to allocation of shares in the amalgamated company were set out.

The trustees for the debenture holders of the Vanguard Company issued a circular to the debenture holders protesting against the scheme. The holders would only receive for each £100 first debenture stock £80 in third debentures, and would obtain only £4 interest instead of £6.

Meetings of the shareholders of the two companies on March 19 approved the scheme, but at a meeting on the same day of the debenture holders of the Vanguard Company the proposal was rejected almost unanimously. On March 20, an application was made on behalf of debenture holders of the Vanguard Company to Mr. Justice Warrington, in the Chancery Division of the High Court of Justice, for the appointment of a receiver and manager of the company. The motion was ordered to stand over, and on March 27 it was again adjourned.

A provisional agreement for the amalgamation of the London Road Car Company and the Great Eastern London Motor Omnibus Company was signed by the directors of the two concerns on March 18, subject to confirmation by the shareholders. The summary of the last report of the Road Car Company as given below shows how heavy is the loss at which it is working. The Great Eastern Company, a smaller and newer concern, has up till now been prosperous.

London Road Car Company.—The report of the directors for the half-year ended December 31 last states that 270 horse and 160 motor cars, on the average, have been running daily during six months, as against 333 horse and 78 motor cars for the corresponding half of 1906. The number of passengers was 40,499,532, being an increase of 4,097,071. The passenger receipts amounted to £223,688, an increase of £19,678, while the total receipts were £236,918, being an increase of £17,665. While the receipts show an increase, the directors view with much concern the falling off in the earnings per car mile of over 1d. in the case of motor cars and ½d. in the case of horse cars. This is attributed to the unseasonable weather during the greater part of the summer, increasing competition by electric tramways, the additional number of motor 'buses worked by rival companies, and the recently opened tube railways. The expenses amount to £248,402, an increase of £43,244. Including the jobbing department expenditure, the total expenses are £253,449. The increase is entirely due to the additional number of motor cars worked by the company. As regards motors, the total cost per mile is not higher than was anticipated, and nearly every item shows a decrease, the actual expenditure per mile run having fallen ·33d., but in the case of horse cars there is an increase of ·28d., largely due to the higher cost of forage. The working loss for the half-year is £16,823. The board recommend that £8,858, being the amount of interest on the first mortgage debenture stock and of the dividend on the preference shares, be transferred from the general reserve fund to profit and loss account. The substitution suspense account has been debited with £27,924, being the book value of the horses, cars, etc., put out of service, and £224, the cost of training drivers, while it has been credited with £3,911, proceeds of sale of horses, and the balance now stands at £115,193.

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MOTOR TRAFFIC.

MOTOR TRAFFIC NOTES.

FIRES ON MOTOR VEHICLES.—The London Fire Brigade annual report states that during 1907, twenty-seven fires broke out on motor omnibuses on the road in the metropolis. Eleven motor cabs caught fire during the same period.

MOTOR FIRE BRIGADE VEHICLES.—The annual report of the London Fire Brigade shows that at the end of last year the brigade possessed six motor steam fire-engines, three motor fire escapes, a motor hose tender, a first-aid motor vehicle, a motor tractor, and three motor cars.

HALLEY'S INDUSTRIAL MOTORS, LIMITED, Yoker, Glasgow, have opened a London office at 25, Victoria Street, Westminster, and garage and repair works at 26, Page Street, Westminster. The same firm have received an order from J. and P. Coats, Limited, the thread manufacturing company, for a 30 H.P. three-ton van.

JOHN I. THORNEYCROFT AND COMPANY, LIMITED, have an order from the London and South Western Railway Company for two 30-H.P. 14-seated single-deck motor 'buses, for service between Exeter and Chagford. A number of Thorneycroft 'buses previously supplied to the same railway company have given much satisfaction.

COST OF RUNNING MOTOR MAIL VANS.—Figures have been published giving the expenses for four months of three 3-ton 28 H.P. motor vans carrying the mails between London and Hastings. The totals work out at 7·375d. per mile run, or, including depreciation allowance, 8·5d. Additional motor mail services are being started.

TRACTORS FOR ROAD REPAIR WORK.—Perthshire County Council have agreed to purchase two motor tractors and wagons at a cost of £1,249. According to figures presented by the road surveyor the cost of hauling road metal by horse and cart is about 10d. per ton per mile, while if the haulage is done by motor tractors the cost will be 4d. per ton-mile.

OMNIBUS TRAFFIC AND EMPTY PROPERTIES.—At a meeting of Chelsea Borough Council on March 18, it was resolved to levy a general rate of 3s. 7d. in the £ for the ensuing half-year, this being the highest rate in the history of the borough. Mr. T. J. Robinson, chairman of the Finance Committee, said that during the last year the number of empty properties in Chelsea had increased by over 800, and this, no doubt, was largely due to the heavy motor omnibus traffic along the main thoroughfares. Although the assessable value had increased, the amount from this source had been swallowed up by the increased demand of outside bodies.

MOTOR CABS IN COVENTRY.—All over the country one continues to hear of applications being made to the local authorities for licences to run motor cabs. It is, however, of particular interest to note that a service of these vehicles has been started in Coventry by Humber and Company, Limited. For a generation or more Coventry has been a home of the manufacture of light machinery, starting with the sewing machine, passing on to the bicycle, and latterly to the motor car. Messrs. Humber have made bicycles of the highest class for many years, and their motor vehicles, the manufacture of which they took up a few years ago, are also very favourably known. Extensive new motor works for the company have just been opened. In starting to run motor cabs the company have a double object in view, one being the ordinary commercial purpose, and the other being the testing in actual work over prolonged periods of various types and appliances of their own manufacture, so that they may evolve the most perfect vehicle possible for manufacture and sale.

LONDON AND SOUTH COAST MOTOR SERVICE.—The second annual meeting of this company was held in London on March 9. Mr. Carlton Roberts, the chairman, said that two years ago they started to create an all-British public motor coach to the design of their engineer, Mr. J. W. Cann. They began their second year with six coaches, and the report now presented showed the results of their steady running for 13½ months. These coaches had passed the experimental stage, and were beyond cavil the finest public motor vehicles extant. Out of six vehicles the average number continuously running was 4·88, and but for an accident caused by the carelessness of an employee it would have been 5·38. The company had earned and were now paying a dividend of six per cent. on the preference shares. The gross profit had been £1,953, or £1,718 for the year, and if the whole of the preference capital had been subscribed they would have had 33 cars instead of 6. That would have enabled dividends of 8 per cent. on the preference shares and 10 per cent. on the ordinary shares to be paid. The board had concluded a contract with the Thames Engineering Company for six further chassis, and these would begin running about Easter. Hitherto they had only been running to Folkestone, but now they would run to Brighton and Eastbourne also. Gradually as they got the cars they would link up the whole of the south coast with the metropolis. The success which had been achieved was in spite of the worst summer weather for 40 years. They ran 119,935 car miles at a total cost per mile run of 8d., while the average receipts had been 12·017d. per mile run.

STAR OMNIBUS COMPANY.—A meeting of this company was held on March 6, to consider a resolution for voluntary winding up. Mr. A. E. Wright, who presided, said that it must be patent to those who had watched the development of the traffic of London that they had had to face a serious problem with the electrified London County Council tramways, the almost mad introduction of motor omnibuses, and the opening of more tubes and the general unification of the same. In all the circumstances there was no alternative but to submit the resolution that day for the voluntary winding-up of the company. Mr. W. A. Perry, the managing director, said that the omnibus industry of London was passing through a very serious crisis, but despite all efforts, the board had not been successful. For the year they had made a loss of £23,695. In the first eight weeks of the current year they had made a loss, and they had lost many of their best routes by the competition of electric cars, and there was nothing left but to come forward with the proposition now submitted. The directors and their friends held nearly half the capital of the company. He moved the resolution, and a discussion followed. Mr. Perry replied, and said that the financial position was that they had, subject to realisation, a surplus of £157,902. The directors hoped to return a substantial amount on the preference capital of £150,000. A receiver had been appointed by the Court on behalf of the debenture-holders. Eventually the resolution for voluntary liquidation was agreed to.

ROYAL AUTOMOBILE CLUB.—The annual meeting was held at the Old War Office (the site for the new Club buildings), Pall Mall, London, on March 12. The chair was taken by Mr. C. D. Rose, M.P., chairman of the Club, supported by the Hon. Arthur Stanley, C.V.O., M.P., Sir David L. Salomons, Bart., Sir Henry Norman, M.P., Col. H. C. L. Holden, R.A., F.R.S., Mr. Robert Todd, Mr. T. H. D. Berridge, M.P., and Mr. W. Worby Beaumont. In moving the adoption of the annual report, a lengthy document showing that the Club had kept in close touch with every section of the automobile movement during the year 1907, the chairman referred particularly to the commercial vehicle trials, the termination of the agreement with the Motor Union, and the action of the committee of the Club in securing the site of the old War Office for the new Club building which it was proposed to erect in order to provide accommodation for the increasing membership, and to facilitate the work of the Club. As regards the accounts, the chairman pointed out that, although there had been a heavy expenditure on the commercial vehicle trials, the committee of the Club had unhesitatingly decided to carry out the trials in view of their great importance. The report and accounts, and the budget for 1908, were adopted. The General Council of the Club was re-elected with the addition of the name of the Marquis A. Ferrero Ventimiglia (president of the Automobile Club of Italy). The president and vice-presidents were re-elected.

MAINTENANCE OF MAIN ROADS.—Mr. Asquith, Chancellor of the Exchequer, and Mr. Burns, President of the Local Government Board, on March 20 received a deputation from the County Councils' Association who urged the necessity of a grant from the Imperial Exchequer towards the maintenance of main roads. The members of the deputation pointed out how great has been the increase of cost for repairing the roads since motor vehicles became common, and contended that the local ratepayers should not be called on to pay the whole cost. Mr. Asquith, in reply, said that there could be no doubt the cost of maintaining the main roads had sensibly increased during the last ten or fifteen years. That increase was due mainly to two causes. There had been, and very properly so, a rise in the standard of the upkeep: and the development of motor traffic had imposed an increased burden upon the main roads. There was good ground for a reconsideration of the whole matter, and the facts and figures laid before him showed that the time had come when the whole matter should be reconsidered, and he was quite prepared, in conjunction with Mr. Burns, to give it very careful consideration. It was all very well to say he must find a remedy. He was constantly hearing that from all sorts and conditions of claimants in regard to every problem of social reform. But the real question here was whether the remedy, partial or complete, was to be found in additional taxation of motor-cars, and if so, how one was to determine the distribution as between the different areas of the country. The question had many sides, and presented great complexity.—It may be mentioned that a large number of local authorities have on the suggestion of the Motor Union passed and forwarded to the Chancellor of the Exchequer a resolution declaring that money raised by the taxation of motor and other vehicles should be paid into a central fund from which grants should be made to local authorities for expenditure on roads. The Scotch County Councils and the Motor Union have also interviewed the Government.

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THE Tramway & Railway World
A REVIEW OF CURRENT PROGRESS IN ELECTRIC AND OTHER TRACTION

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TILBURY RAILWAY ELECTRIFICATION.

On April 1 last the Metropolitan District electric train service was extended to the new station of the London, Tilbury, and Southend Railway at Barking, this event marking the completion of the great work which the Tilbury Company has been carrying on in this neighbourhood for over two years past. From East Ham to Barking, a distance of 1¾ miles, a new double track has been laid down and electrically equipped, while the Forest Gate line from Stevenage Road Bridge to Barking Station (⅝ mile) has been diverted to the north of the new line. On the other side of the electric railway is the Fenchurch Street line, and, as all these railways are double track, there are now six main lines running through Barking instead of the two roads only, which were formerly available. Some idea of the extent of the work may be gauged by the new width of way compared with the old. Across Barking Station the width between boundaries is now 300 ft., as against 170 ft. formerly; the width at Queen's Road Bridge has been increased from 50 to 70 ft. while the railway and sidings on the west side of Queen's Road are now 164 ft. across, as compared with the old width of 80 ft. These works necessitated the construction of an entirely new station at Barking, with four island platforms providing accommodation for eight trains, in the place of the two small platforms which formerly comprised the station.

The main object of the new works has been to relieve the congestion of traffic caused by the old Tanner Street Junction of the Fenchurch Street and the St. Pancras and Liverpool Street lines. At this point, some 350 yards to the west of Barking Station, the trains from Liverpool Street and St. Pancras running over the Forest Gate line were thrown on to the Fenchurch Street line, and as there was only one pair of roads, common to both branches, through Barking Station, there was naturally a good deal of delay occasioned by trains holding each other up just outside the station. Of late years the crowding of the traffic upon this point has been found very inconvenient, especially during the summer, when the Southend traffic is at its height. In addition to the Southend traffic, there is also a special service of trains to and

Steam Roads. Electric Roads.

New Station of the London, Tilbury, and Southend Railway at Barking.

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from Tilbury and Fenchurch Street, St. Pancras, and Liverpool Street in connection with the sailings of both pleasure steamers and ocean liners. The goods traffic to Tilbury Docks is also very considerable.

The reasons for increased accommodation enumerated above all relate to the through traffic. Scarcely less important has been the demand for greater facilities to cope with the growing suburban traffic to and from the city. The alliance with the Metropolitan District Railway enabled through electric trains to be run to and from East Ham and Wimbledon, Hammersmith, etc., *via* Aldgate East and Mark Lane. The electrical equipment of the Tilbury Company's section was carried out to the same standard as that obtaining on the District lines.

In view of their increasing suburban traffic, the directors of the London, Tilbury, and Southend Company decided to extend the electrical service from East Ham to Barking, a distance of 1¾ miles. Powers to construct the line and to carry out the necessary widening of way were obtained from Parliament on July 22, 1904. This was followed by the acquisition of the lands required for the purpose, and the first contract was let in November, 1905. Work was commenced on January 1, 1906.

Electric Tracks at Barking Station.

In the full description of the electrification of the District Railway published in THE TRAMWAY AND RAILWAY WORLD of February 9, 1905, reference was made to the extension of the work over the Tilbury line, but at that time, of course, the alterations and construction to the east were only in contemplation. It may be recalled that the current for working the electric trains on the Tilbury line is obtained from the Chelsea power-station of the Underground Electric Railways Company of London. The high-tension feeder cables, carrying three-phase current at a pressure of 11,000 volts, are led along the tunnels of the District and Whitechapel and Bow Railways to the two sub-stations at Campbell Road Junction and East Ham. Each of these is equipped with two rotary converters of a capacity of 1,200 KW. each, giving 4,800 KW. in all. The tension of the incoming current is reduced in the usual way by transformers, whilst the converters change it into continuous current for sending out to the conductor rails. The switchboard and other arrangements are similar to those in the sub-stations of the District Railway, and the installation of third and fourth conductor rails is also identical. These rails are of **T** section, weigh 100 lb. per yard, and have an electric resistance of only 6½ times that of pure copper. They are divided into sections, which are fed separately by low-tension cables from the sub-stations.

It is of special interest to note that the distance over which the high-tension cables are laid from the Chelsea power-station to the East Ham sub-station is over 14 miles. Economical transmission of a large horse-power over such a distance is only rendered possible by the high voltage used.

In order to bring the electrical tracks into Barking it was necessary to divert the Forest Gate line, and to do away with the troublesome junction at Tanner Street level crossing. The deviation commences at Stevenage Road Bridge, and between this point and the viaduct which carries the railway over the River Roding, the new electric tracks enter the old section of the Forest Gate line, and are continued to the site of the old Tanner Street Junction, where, instead of being turned on to the Fenchurch Street line, they are continued straight through Barking station. There are now no junctions necessitating crossing over to the west of Barking Station. On all through routes, viz., from St. Pancras and Liverpool Street, from the Mansion House and Whitechapel, and from Fenchurch Street, the trains enter Barking Station on independent roads. The electric tracks are dead-ended just beyond the station. The Fenchurch line is continued to Tilbury, and the Forest Gate branch to Southend, the cross-over (*i.e.*, for Fenchurch trains to Southend, or for St. Pancras trains to Tilbury) being effected a few yards to the east of the termination of the electric tracks.

Some details of the heavy work occasioned by the widening of way are of interest. The bridge over the River Roding has had an additional double-line span added, and it now consists of three spans of 50 ft. carried on cast-iron cylinders. The old Tanner Street Junction level crossing has been abolished, and a new foot-bridge has been substituted. The alterations also necessitated the widening of the Queen's Road Bridge, which has been extended northward by a new span of 75 ft. The width of the bridge is about 30 ft.

Barking Station is the outward and visible expression of the great work which the Tilbury Company has accomplished on the permanent

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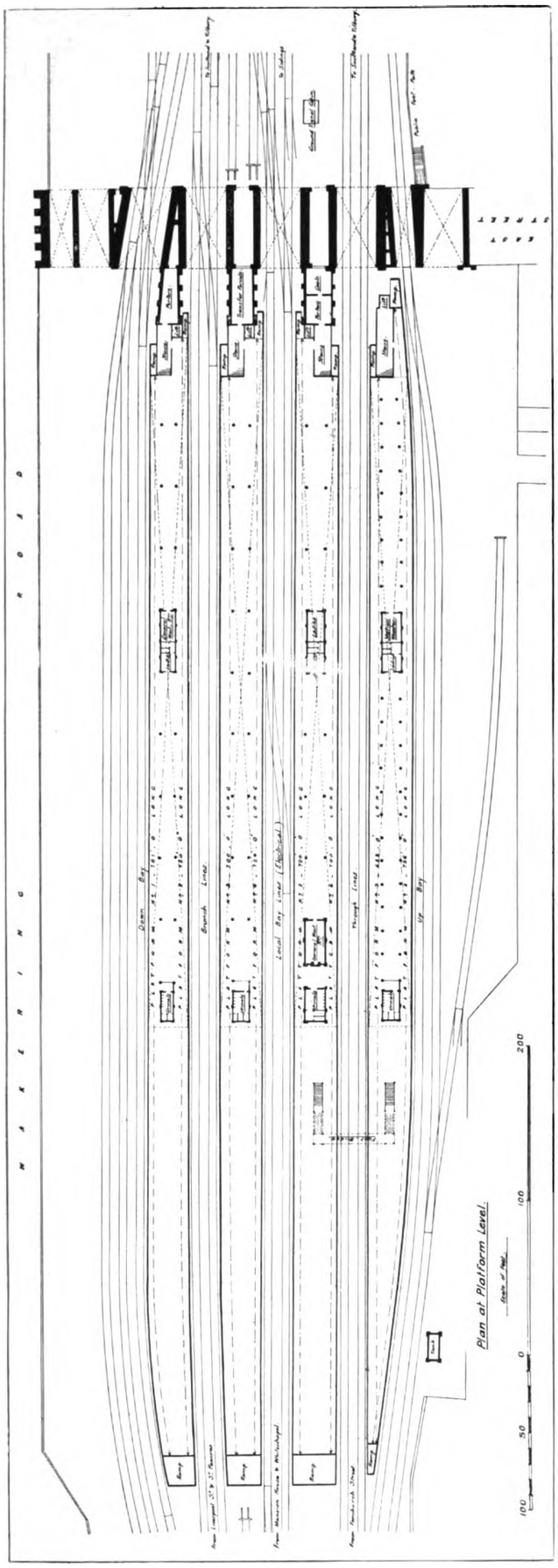
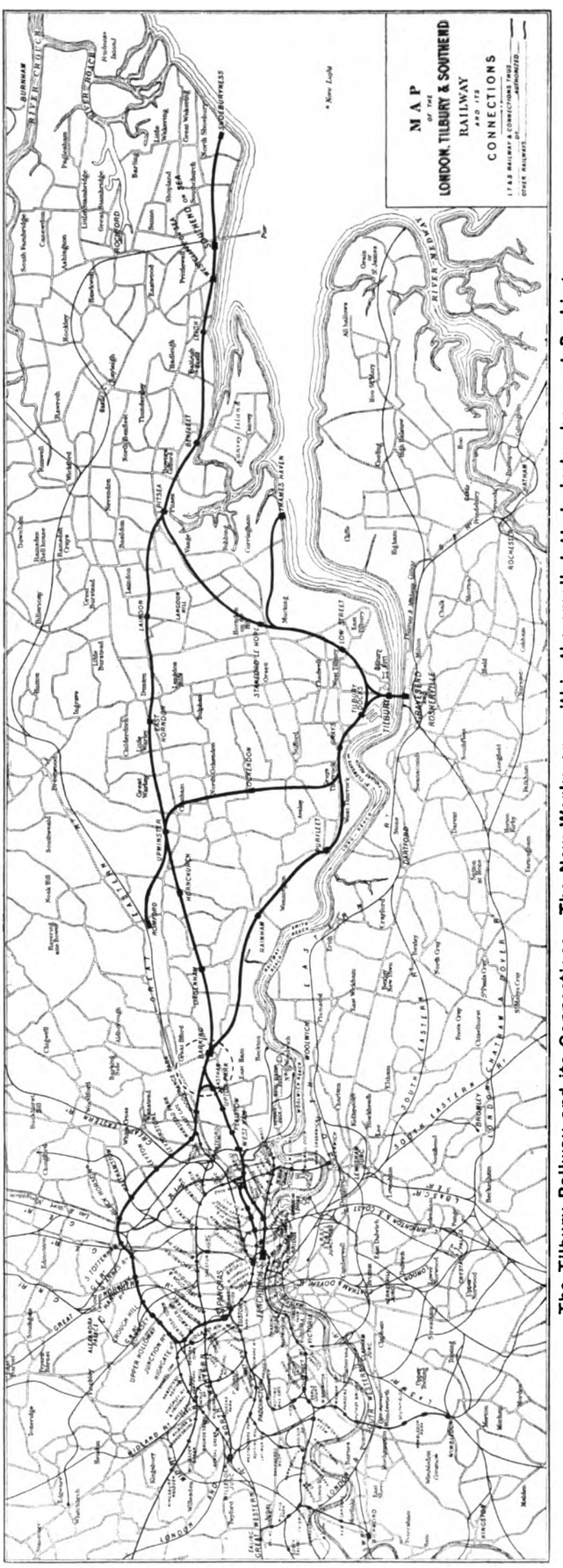


Plan of the London, Tilbury, and Southend Railway Company's New Station at Barking.



The Tilbury Railway and its Connections. The New Works are within the small dotted circle shown at Barking.

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way. Views of the new station are reproduced from photographs specially taken. Four large island platforms (this would be eight platforms in railway parlance) take the place of the two old platforms. Their length has been increased from 550 ft. to over 700 ft., and they have also been considerably widened. The new platforms vary slightly in length: the actual dimensions will be found on the station plan here shown. Eight trains can now be accommodated at the same time, instead of four, which was the previous maximum.

The entrance to the station is from East Street Bridge, an entirely new structure which takes the place of the old level crossing. This is a bridge of eleven arches, about 50 ft. wide between parapets. One span was built on the cantilever principle on account of the small amount of construction room. Five long approach roads have been built. The main road over the bridge leads to Ilford, and carries the Barking electric tramways.

The booking hall is a spacious structure over 100 ft. in length, which takes the place of a dark and cramped booking hall on the up platform near the old level crossing. Four broad staircases and as many luggage lifts lead down to the platforms. Each of the platforms, which average about 30 ft. wide, is supplied with the necessary waiting room accommodation. Umbrella awnings have been erected, resting partly upon short iron beams laid across the waiting room walls, and partly upon ranges of longitudinal lattice girders supported by pairs of hollow cast iron pillars. The latter are painted grass green, and decorated with gold leaf, the whole structure giving a very light and pleasing effect. The Tilbury officials are naturally very proud of this fine station, which they regard as the "Clapham Junction of the East." Some idea of its area may be gathered from the fact that the width across the station, including the passenger bay roads on either side, is 194 ft., or 30 ft. wider than Charing Cross Station.

The signal equipment of the new roads is very extensive. Five new cabins have been erected, viz.: Little Ilford No. 1, with 60 levers; Little Ilford No. 2, 84 levers; Little Ilford No. 3, 34 levers; Barking West, 160 levers; and Barking East with 125 levers.

The works were designed by Mr. J. R. Robertson, chief engineer of the London, Tilbury, and Southend Railway, and carried out under the supervision of Mr. S. Heaton-Ellis, resident engineer. All the earthworks and permanent way construction were done by the company's own men, under the direction of Mr. H. W. Stride, district engineer. The contract for the East Street viaduct, the station buildings, platforms, and bridges was given to Messrs. Mowlem and Company; the widening contract for the Roding viaduct was entrusted to Messrs. Charles Wall, Limited; and the ironwork of the platform shelters, etc., was provided by Messrs. Matthew T. Shaw and Company, of Millwall. The electric equipment of the tracks was carried out by the Tilbury Company under the supervision of their engineers. Westinghouse machinery is used in the sub-stations.

To the courtesy of Mr. J. R. Robertson, Mr. H. W. Stride, and Mr. Heaton-Ellis we are indebted for the foregoing particulars and plans, and to Mr. B. Bullock, manager of the London, Tilbury, and Southend Railway, for information and assistance in the preparation of this article.

AN OMNIBUS PROPOSAL FOR YORK.

Mr. T. Graham Gribble, M.Inst.C.E., one of the consulting engineers for the London Electrobus Company, has suggested to the York Town Council, that, instead of constructing the tramways authorised by the recently-granted Light Railway Order, they should try a service of electric omnibuses. He has also written to the local newspapers, setting out his views at great length. As the power to construct the tramways has been obtained, the new suggestions are rather late so far as York is concerned, but what Mr. Gribble has to say is of some general interest. He explains the methods of operation of the two kinds of electric omnibuses, namely those with accumulators, and those which take their power from overhead wires, as in the case of electric tramcars. The advantages claimed for omnibuses are low capital expenditure and possibility of serving a wider area. The cost of an electric omnibus installation for running over 16 miles of route is put at £60,000, while 6 route miles of tramways would cost £120,000. Mr. Gribble points out the features of superiority of the accumulator 'bus over the petrol vehicle, and in reference to the trolley wire 'bus says that half-a-dozen installations of the kind are in successful operation in Germany. The first type has the advantage of being applicable where overhead wires are objected to, but it is more expensive to run. The second type is in all probability the most economical form of traction on ordinary highways that has yet been devised. Mr. Gribble urges that the claims of the omnibus should be considered, as he thinks that in such a town as York a tramway has no chance of commercial success.

BUENOS AYRES TRAMWAYS.

A recent issue of the Bulletin of Municipal Statistics, officially published by the City of Buenos Ayres, contains the following information with reference to the local electric tramways:

Company.	Length of Route (Miles).	Rolling Stock.	Employees.
Anglo-Argentine	98·0	804	2,160
Buenos Ayres Belgrano	35·8	207	645
The Capital	35·08	153	720
Buenos Ayres Electric Company ..	24·01	85	447
The Metropolitan	20·5	90	465
Grand National	75·67	427	1,375
Lacroze of Buenos Ayres, Limited..	22·44	62	435
Belga-Argentine	10·10	30	80
Southern Electric Company.. ..	5·21	8	47
Total	326·81	1,866	6,374

From these figures it appears that the City of Buenos Ayres has over one-eighth as great a mileage of electric tramways as the whole of the United Kingdom.

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MULTIPLE-UNIT TRAIN CONTROL ON THE LANCASHIRE AND YORKSHIRE RAILWAY.

The principle of the multiple-unit system of train control is now recognised as the best for railway systems working with continuous current. The absence of power cables through the train and their attendant dangers, and also the absence of heavy currents in the controller are the great recommendations of this system. At present there are three distinct types of multiple-unit control in use: (1) direct electro-magnetic, with solenoids working the main switches, current being supplied at the line voltage; (2) electro-pneumatic, with low voltage electro-magnetic valves controlling air pressure to pneumatic cylinders, the pistons working the main switches; (3) direct electro-magnetic, with solenoids carrying the main return current from the train motors to the rails. It is the third system that has been adopted by Messrs. Dick, Kerr and Company, and fitted on the Lancashire and Yorkshire electric line.

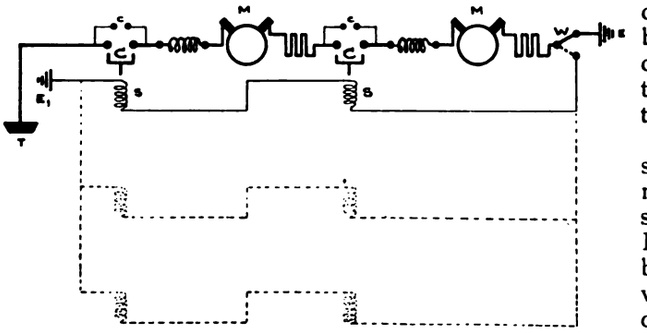

Fig. 1.—Solenoid Connection.

A reference to Fig. 1 will show the ingenious manner in which the system of the series working of the solenoids has been carried out. T is the trolley shoe, and M M are the motors. E E_1 are earth connections. The circuit between the trolley shoe and earth can be closed either by way of the contacts c c. and E, or contacts C C, solenoids S S and E_1. The first thing to be done is to establish a circuit between the trolley shoe and earth. This is done by closing the contacts c c through the motors to earth E_1, *via* the two-way switch W. As soon as this circuit is completed the motors start up. The negative or return current after passing through the motors goes to earth round the solenoids S S, and these being energised, the main contacts C C are closed. If now the auxiliary contacts c c are opened, no circuit is broken, as the main contacts C C are still closed. In order to open circuit and stop the train, the switch W is moved to E. The current is now cut off from the solenoids S S, which become de-energised, and the main contacts C C fall away. The circuit W, S, S, E_1, can be paralleled by others as shown by the dotted lines, containing as many solenoids as are required for control purposes, and elaboration of W will cause these solenoids to be brought in and out of circuit. This explains simply the principle upon which the control is based.

The application of this system to a simple two-motor car equipment is shown diagrammatically in Fig. 3. This diagram has been drawn to simplify the wiring connections, and does not include the motor cut-out switches. The main portions of the control consist of the master controller and the contactors, the latter including reversers, resistance contactors, and series parallel contactors. There are two master controllers on each motor car, one at each end in the driver's cab, and the contactor boxes are hung beneath the underframe, midway between the bogies. The master controller, Figs. 2 and 3, is made up of three distinct parts: (1) the switch barrel; (2) the contactor barrel; (3) the reverser barrel.

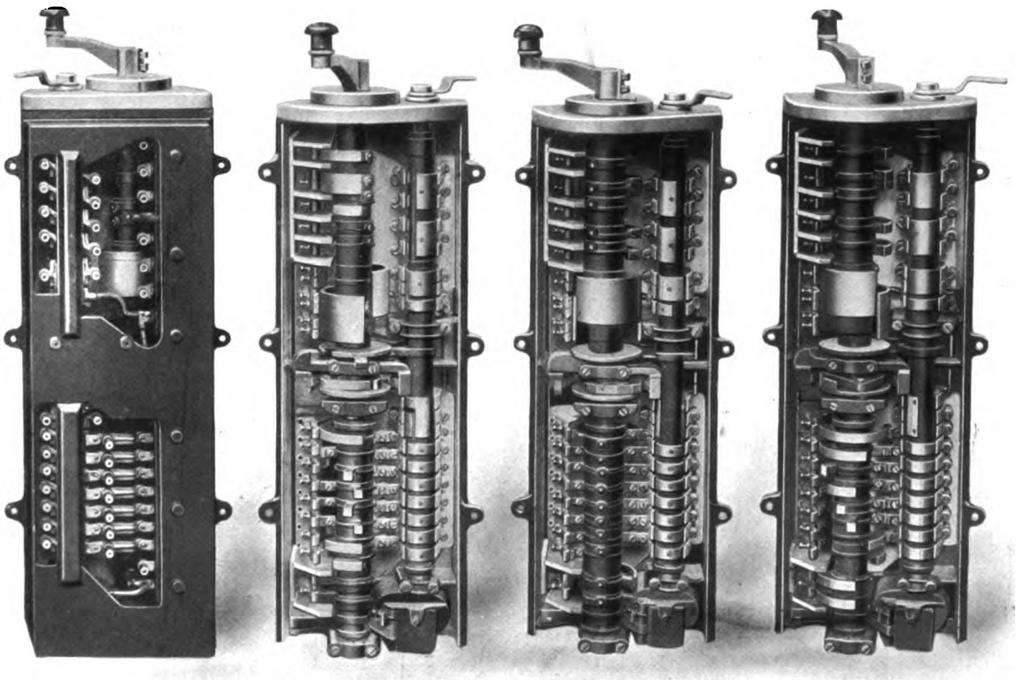

Fig. 2.—The Master Controller.

The switch barrel and the contactor barrel are in the same vertical plane, one above the other, and are moved by the main operating handle. The former, however, travels independently of the latter through a certain arc indicated on the diagram, after which the two move forward together. There are eight notches on the controller, and these are numbered on the

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diagram to facilitate the tracing of the connections. The reverser barrel is in two parts, with a drum for switching in either the forward or reverse set of contactors, and a drum for reversing the control circuit through both motors.

The first movement in starting the train is to move the reversing handle from the off position to either the "forward" or "reverse" notch. This closes the auxiliary circuits which carry the control currents through the motors, fields and resistances to earth at the earthing sector of the master control. Notching-up on the main barrel of the controller may now commence. Supposing that the train has to move forward, the rings on the reversing barrel are moved to the left on the diagram. On the first notch of the master controller, the auxiliary circuit is connected to the live main and a current flows through the solenoids numbered 1, 8, 9, 10 and 11 on the diagram. The energising of these solenoids closes the corresponding contactors and consequently the main power circuit through the motors is completed. It is important to notice that this power current returns to earth from contact R6 through these five solenoids in parallel, so that each solenoid carries a comparatively small current. This is always the case, there never being less than five solenoids carrying the main return current. On notches 2, 3, 4 and 5 resistances are cut out so that on notch 5 the motors are in full series.

On notch 6 paralleling begins. When the controller rings leave notch 5 the resistance contactors 2, 3, 4 and 5 fall away, as does also the paralleling contactor 1. On notch 6, the motors are in parallel with their full resistances in series, motor No. 1 being connected to ground on the closing of contactor 16. The coil carrying the current operating this switch is designated the heavy coil, as it carries the main current passing through motor No. 2. The current operating contactors 8, 9, 10 and 11 is that flowing through motor No 2, that through motor No. 1 going straight to earth. On stops 7 and 8 the series resistance is cut out, and on this latter stop the motors are in full parallel, and the train is going at its maximum speed.

To switch the train motors off, the controller handle is returned to the zero notch. This brings back the switch barrel of the master controller independently of the contactor barrel which remains on full parallel. This movement brings back the earthing sector on the switch barrel, so that the current returns to earth at the point E, thus cutting off the supply to the solenoids. The contactors, therefore, drop away and the circuit is broken.

It is important to recognise that the earth connections for the contactor and diverter circuits are at opposite ends of the train. The former must, of course, be at the rear of the train, as the current must pass through all the contactors on the various motor coaches before it returns to earth. The earthing point E, to which this return current is diverted when switching off, is at the front end of the train. To allow of control being effected from either end of the train, the entire control system is paralleled at the front and rear master controllers.

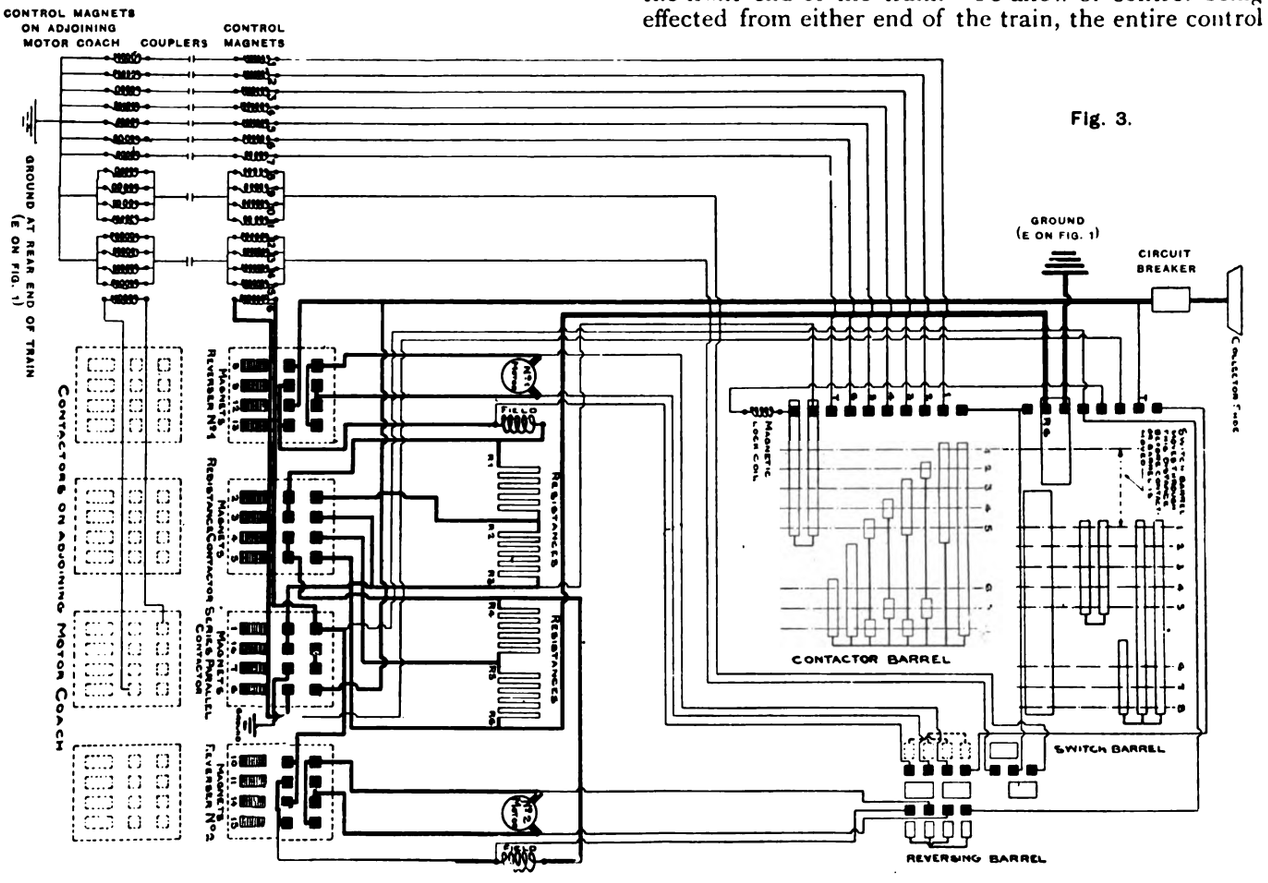

Fig. 3.

In the base of the master controller is fitted a magnetic lock coil, which is shown in the diagram. This is in series with the contactor solenoid which determines the series connection of the motors. When this coil is energised, it releases a catch which allows notching up to proceed, but should, from any reason, the series circuit be not established, the controller is securely locked and cannot be notched up.

The master controller is fitted with a mechanical regulator, which only admits of notching up a step at a time. The handle is locked on each notch, and is only released by a slight backward pressure, after which it can be moved to the next notch. By this means the motorman is prevented from rushing through his resistance notches, and a certain time has to be spent to allow of the motors gathering speed.

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The master controller is small in size, as it is not required to break any current, and, consequently, no blow-out has to be fitted. We give a view of the master controller (Fig. 2), and from this the arrangement of the controller barrels will be better understood. The position of the switch barrel at the top, with respect to the contactor barrel at the bottom, is clearly shown. The mechanical regulator referred to above is placed below the controller top above the switch barrel. By this simple means automatic notching up arrangements are dispensed with, and it enables shunting to be done without special provision being made for it.

Fig. 6 is an outline drawing of a single contactor, showing the complete solenoid and the switch which it operates, together with the blow-out device for disrupting the arc on breaking the circuit. Four contactors are placed in a single iron box, and the four boxes required for each motor car are hung under the carriage frame. Referring to Fig. 6, A is the iron supporting box, B the series solenoid, C C_1 the switch contacts, and D the insulating support for the switch parts. The lower end of the solenoid plunger is seen at E, and the upper extremity, which is not shown in the diagram, is connected to a lever, one end of which carries the contact finger C_1. When current is switched on round the series solenoid the plunger E moves smartly up, and the contact C_1 is brought up against

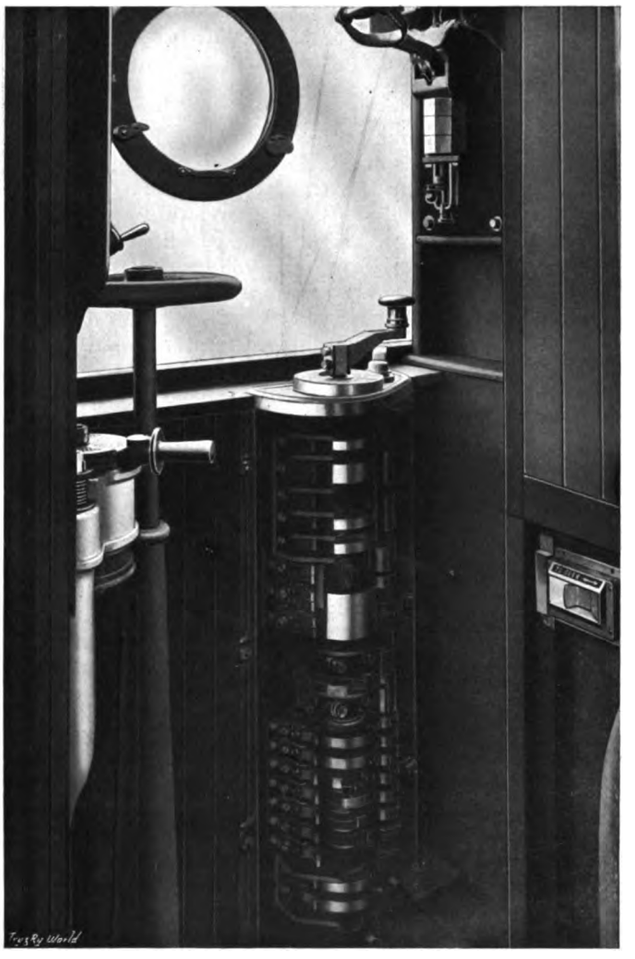

Fig. 4.—Master Controller in Driver's Cab.

contact C. This latter contact is hinged in such a way that it tends to turn under the pressure of the solenoid plunger, thus causing the two contact fingers to rub slightly as each connection is made. This rubbing action keeps the contact surfaces clean, and any copper globules that may be formed are rubbed off. As the self-induction of the series solenoid is small, the switches make prompt response to the movements of the master controller.

The action of the blow-out may briefly be described.

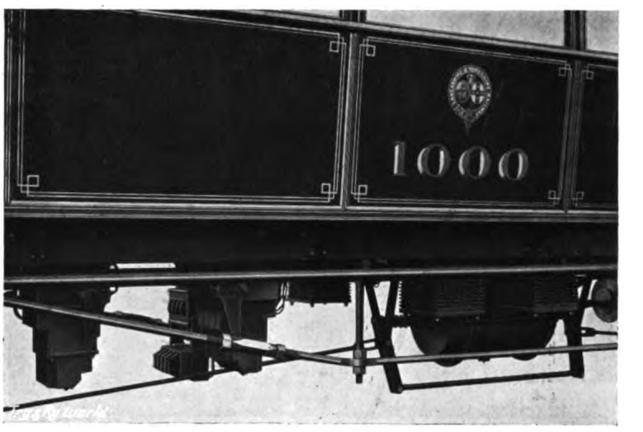

Fig. 5.—Contactors and Resistances under Coach.

The metallic shield blow-out F consists of a coil G surrounded by a short copper tube H, this latter being for the protection of the coil. The inside edge of this tube is close to the contacts CC_1, and the outer edge to the opening in the casing J. The arc formed between CC_1, is at once attracted to the coil G, and as it strikes the tube H, it is compelled to travel round it, being

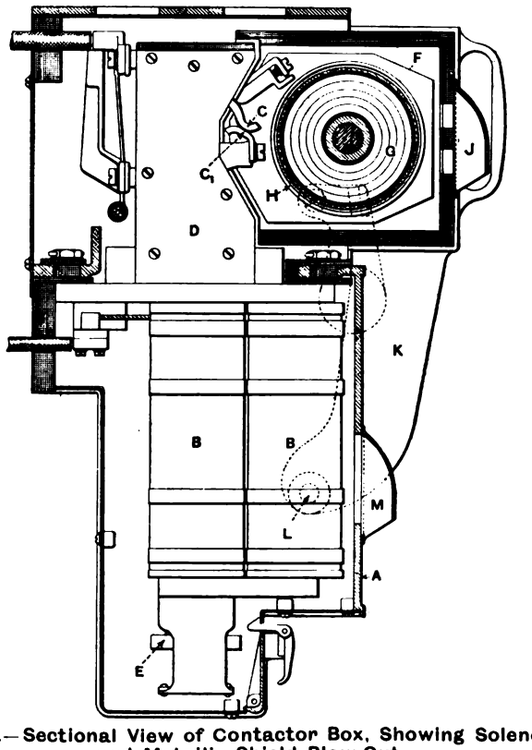

Fig. 6.—Sectional View of Contactor Box, Showing Solenoid and Metallic Shield Blow-Out.

drawn away from the contacts and finally broken opposite J. This blow-out which Messrs. Dick, Kerr and Company have applied to their tramcar controllers, standard circuit breakers, etc., for several years past is very effectual, the arc being dispersed practically instantaneously. The blow-out coils for the four contactors are wound on a common iron core supported by the carrier K, which is hinged on a pin at the point L, to allow of all the contacts being inspected when the carrier is swung down. Each blow-out holder is fitted with vulcabeston division plates to

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divide off each contactor from its neighbour. Each contactor is designed to carry a maximum of 300 amperes, and the solenoids carry a normal current of about 10 amperes each; the minimum current required to hold the switches shut is about 5 amperes, it being important that they do not keep closed when a small current is passing round them. When the solenoids are de-energised, the plungers fall by gravity.

The remaining portion of the equipments is made up of the iron grid resistances which are slung under the coaches.

The master controller used in this system is larger than that usually employed for multiple-unit control systems, but the switch mechanism beneath the car is correspondingly reduced. The actual notching-up is directly in the hands of the motorman, so that automatic accelerating switches are dispensed with, the safety lock on the controller handle stopping too rapid acceleration by injudicious motormen.

As the motor control circuits need to be coupled up in series, as already explained, special provision must be made at the ends of the coaches to carry through the leads so that the sets on each coach will correspond with one another. This is effected by special plugs and sockets at the end of each coach, whether it be motor or trailer. Views of these plugs are shewn in Figs. 7 and 8. That illustrated in Fig. 8 is used for connecting the trolley wires of one coach with those of the next, while the socket illustrated in Fig. 7 is only used at either end of the train to place the plug in. The couplers are so arranged that when the plug is taken out of the socket in Fig. 8, all the six train leads are earthed, while in the socket of Fig. 7 the matter is reversed, the six leads being earthed when the plug is in position. Each coach has one socket like Fig. 8, and one like Fig. 7 at each end of the coach, and the plug is placed immediately below the coupler in Fig. 7. It will be seen that the mere fact of disconnecting the

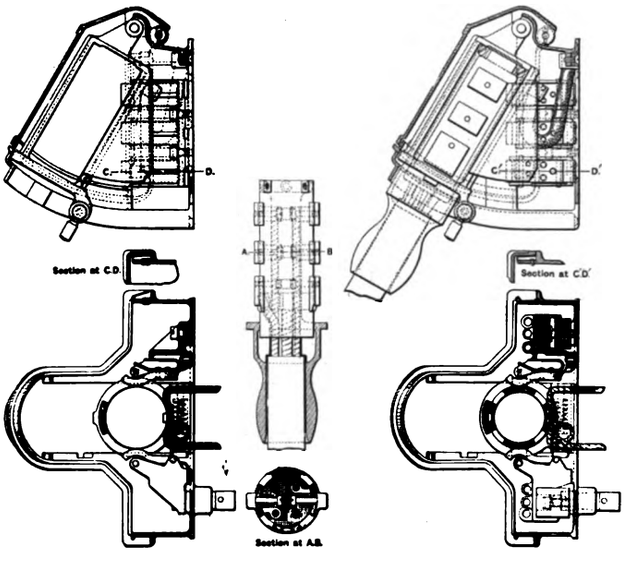

Fig. 7.—Dummy Socket for Coupler Plug.

Fig. 8.—Wire Trolley Train Coupler and Socket.

plugs, and placing them into the sockets above them, earths all the nine train wires. There are also smaller cable couplings which form part of a special circuit provided in connection with the electrical control of the valve on the vacuum brake cylinder.

In our issues of April 14, 1904, and July 12, 1906, we published a full description of the electrical equipment of the Lancashire and Yorkshire Railway's electrified lines as it then existed. It will be sufficient for the purposes of this article to say that the conditions under which the motors have to work are exceptionally severe. On the Liverpool and Southport electric line the line voltage is 650, and on the Liverpool Overhead Railway, over whose tracks the Lancashire and Yorkshire trains run, it is 500. As the latter railway is a suburban one a large amount of accelerating must be done, and, consequently, the motors have to be extremely well ventilated. Large air ducts pass right through the pole to the outer shell, through which the

Fig. 9.—Detail Views of Control Connecting-Plug and Socket.

hot air is thrown by the action of the rotating armature against the cool outer shell. The armature bearings are self-centreing, and are fitted with oil ring lubrication. The axle bearings are very large and provided with pad lubrication.

Generally speaking, the control system consists of nine train wires which are earthed at both ends of the train. Each master controller has a cut-out arrangement which opens up the train leads at the particular point at which the master controller is situated. This cut-out switch is combined with a reversing switch, so that if this switch be moved to either "ahead" or "reverse," the train leads are disconnected, thus leaving the nine train wires grounded at the farther end of the train, and the master switch is, therefore, ready to be operated. In taking the reversing handle off the master controller, the switch must be brought to the "off" position which again connects the train leads, so that the train can be operated from the other end or any intermediate point.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

The "Official Circular" for April states that although no definite date has yet been fixed for the Tramway Congress to be held at the Franco-British Exhibition in July, it will probably take place on either July 3 or 10. Four papers will be read, and a dinner of the members of the Association will follow. Full particulars will be given in the May "Circular." The Association's report on brakes is nearing completion, and it is hoped that it will be found possible to publish it early in the summer. Nearly eighteen months have been devoted to investigation by the special committee appointed to go into this question, and their report is expected to be both full and comprehensive. The "Circular" contains a copy of the Home Office amended draft regulations for electric stations and factories as agreed between the representatives of the Home Office and the Committee of Objectors.

London County Council Cars.—The London County Council now has 1,050 electric cars, so that when the 175, for which tenders will be received on May 9, have been delivered, the total will be increased to 1,225 electric cars.

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THE THOMSON-HOUSTON MAGNETIC BRAKE.

The increasing size and weight of electric tramway cars, the steepness of the gradients that exist on many systems, and the number of accidents which have occurred, emphasise the necessity for reliable brakes which can be depended on to control these cars under all conditions met with in service, and to stop them with the utmost rapidity in cases of emergency.

Various more or less successful attempts have been made to meet these requirements, and the British Thomson-Houston Company have developed a noteworthy form of brake to which the name electro-mechanical track brake has been assigned. This track brake is a modified form of the well-known magnetic slipper brake, and has been designed to operate either electrically or mechanically. If desired both methods of application may be used at the same time in order to secure greater braking effect.

The brake is applied electrically by turning the controller handle on to the braking notches, thus connecting the exciting coils of the magnets to the motor circuits, while the exciting current generated by the motor is regulated by the rheostats. The operation of the brake is thus independent of the trolley. The magnetic action of the shoes causes them to be drawn down upon the rails with a force of several tons, depending upon the size of the magnet used, and the friction thus produced causes very rapid retardation of the car.

To enable the track brake to be applied by hand, a floating lever (marked A in Fig. 1) is supported by a suitable bracket to the centre of the car underframe. The long arms of the lever are each connected by pull-rods to the brake spindle, operated by a hand-wheel on the driver's platform in the manner shown in the illustration. The short arms of the floating lever transmit the pull through chains to rocking levers on the truck side frames. Each rocking lever consists of an adjustable link B pivoted to a bracket C, and of a compression link D, the lower end of which is connected to the brake magnet. When the upper ends of the rocking levers are drawn towards the centre of the car by the chains, the compression links D force the brake magnets downwards on the rails. The retarding effect of the magnets is transmitted to the car by the brackets C. This arrangement enables the driver, by applying the handwheel, to put a pressure of several tons on the brake magnets. This pressure can be still further increased by applying the brake electrically as well as mechanically.

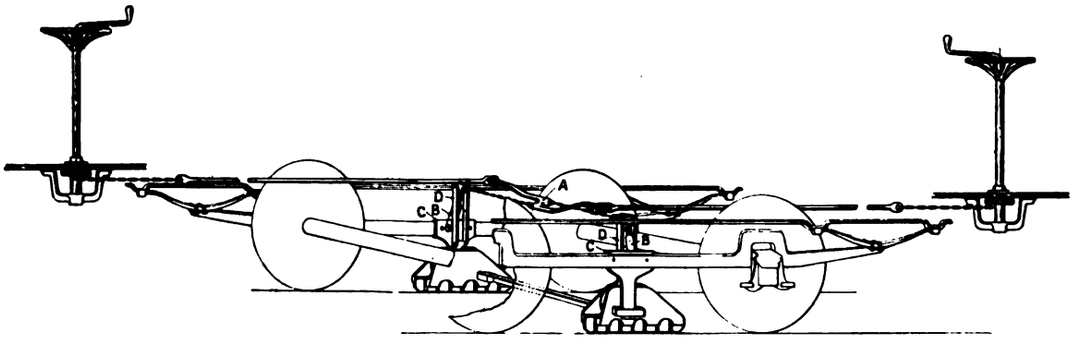

Fig. 1.—Connections for Hand Application.

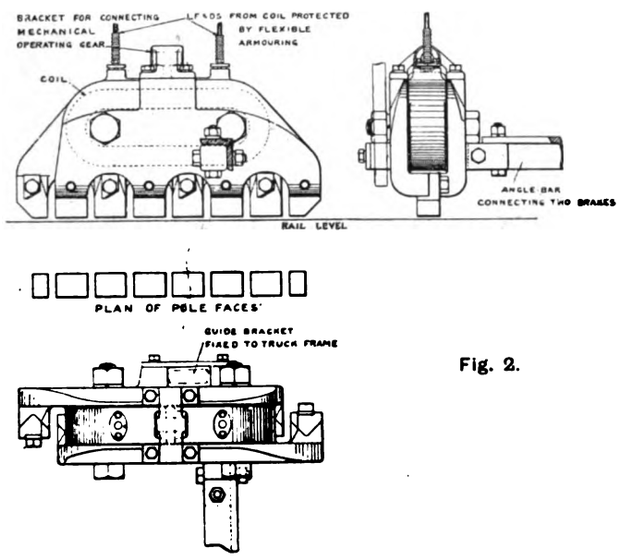

Fig. 2.

By applying the brake mechanically at the top of a gradient, the speed of car when descending may be maintained at any desired rate, and the car may be brought to rest by further applying the brake either by hand or magnetically, or by the use of the wheel brake if desired. Tests have been made on a car fitted with this brake on a gradient of 1 in 12, and even with the track brake applied mechanically only, very rapid stops were made at speeds up to 16 and 17 miles per hour. Very satisfactory results were obtained both on wet and very greasy rails. Remarkably rapid stops were made with the brake applied electrically, the rate of braking on level track reaching 12 feet per second per second.

The brake consists of a pair of electro-magnets, provided with renewable track shoes. The magnets are connected together by a bar spanning the track, and are suspended from the truck frame by spiral springs which hold them clear of the rail when not in operation. The thrust occasioned by the retarding action of the brake is taken on a tongue-shaped steel bracket, which is bolted to the truck and engages with jaws on the side of the magnets. Brackets are also fastened to the upper part of the magnet, to provide connection to the lever for operating the brake mechanically. The design of the magnet is multipolar. Each magnet consists of two main steel castings which, bolted together, form a spool with deep elongated flanges. The lower edge of each flange terminates in a number of lugs projecting inwards, the two sets of lugs interlacing with each other but separated by air gaps. To these lugs the wearing shoes are fastened. They consist of blocks of iron or steel shaped in such a way as to facilitate renewal and provide a strong rigid connection to the magnet. As the magnet coil is the most vital part of the brake, special care has been taken to ensure its insulation and protection against injury. It is completely enclosed in a watertight metallic cover. The terminals of the coil are insulated leads, brought out through carefully machined stuffing boxes, covered with flexible armouring, and arranged for connecting to the controller cables.

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THE PRINGLE NON-SKID EMERGENCY BRAKE.

Mr. P. J. Pringle, borough electrical engineer and tramways manager, of Burton-on-Trent, has for some time been engaged in the development of an emergency brake designed for use only in case of the failure of the service brakes. Numerous trials have been made with the apparatus, which is now perfected and available for use.

The accompanying illustrations show the design of the brake and the simplicity of its operation. Mr. Pringle maintains that every car should be fitted with an alternate brake capable of being simply and readily applied under any condition that may arise in the event of the service brake proving defective or being wrongly operated. In considering the problem he rejected every device which made use of the car wheels and, after various experiments, he came to the conclusion that the rail groove afforded the most effective place for the application of the brake power. Following out this idea the brake which is shown in the accompanying illustrations applied to a single truck car has been designed. The brake-block—B, in Fig. 1—is shaped in the lower part to the upper part of the rail-groove. The block is also provided on its upper part with flanges and an inclined groove to engage with the wheel-flange. When the brake is applied, the brake-blocks fall into the rail grooves just in front of the wheels. The latter at once mount the skid, and all the weight carried on the wheels to which the brake is applied thus becomes the braking pressure which is applied without any exertion or action on the part of the driver beyond the release of the operating handle. As the lower part of the skid is forced into the rail groove the wedging action increases the retarding effect so that the car is stopped in a short distance, even though the speed be that of a car which is completely beyond control on as sharp a gradient as exists on any tramway. To answer at once a question which will inevitably leap to the mind of the reader, we may say, that rapid as the retardation is, the stop is effected with surprisingly little shock. We have frequently experienced much more severe stops in ordinary service braking than was felt in the tests of the emergency brake to which reference will be made below.

The action of the brake will be understood on reference to Fig. 1, but a few supplementary notes may be useful. To apply the brake at either end of the car, it is necessary only to depress the braking handle—which is adjacent to the controller—in the direction in which the car is moving, viz., forward or backward. The operating gear is identical at both ends of the car, so that either conductor or driver may apply the brake. On depressing the operating lever J, the catch K, which holds the trip-lever L in the off position, is released. The steel wire cord extending from L to the brake blocks is loosened, and the latter fall into the grooves and under the wheels. The brake block is suspended by links, D, from the side-bar of the truck by a cast malleable iron bracket, A, secured to the bar with four bolts. The links, D, are placed on each side of the brake-block, and suspend this block from the bracket, A, in somewhat the same manner as an ordinary brake-block is hung. When the skid-bar is dropped into the rail-groove a compression spring, G, increases the pressure into the rail. The spring also serves to hold all the gear rigid, so that chattering of the parts is prevented. The guide-plates, I, cast with the brake-block, B, embrace the wheel on each side, and these guide plates, together with the skid-bar in the groove, cause a powerful keying action between the wheels and track, and so reduce the liability of derailment.

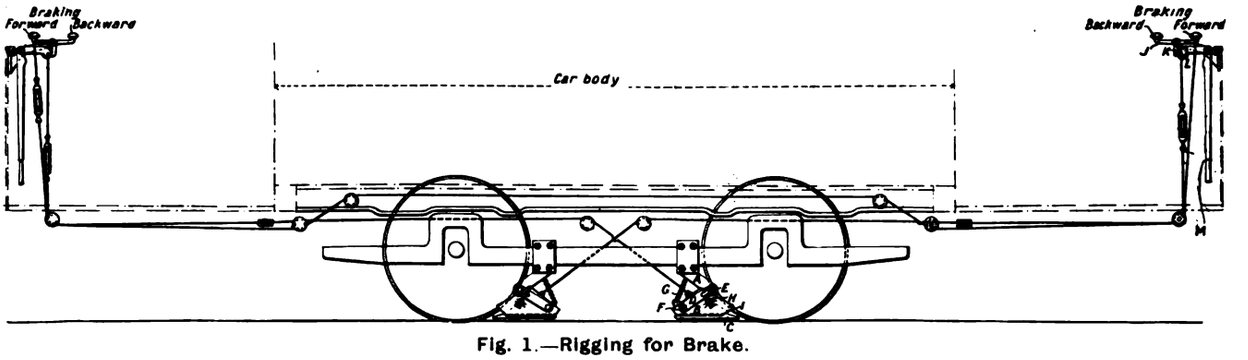

Fig. 1.—Rigging for Brake.

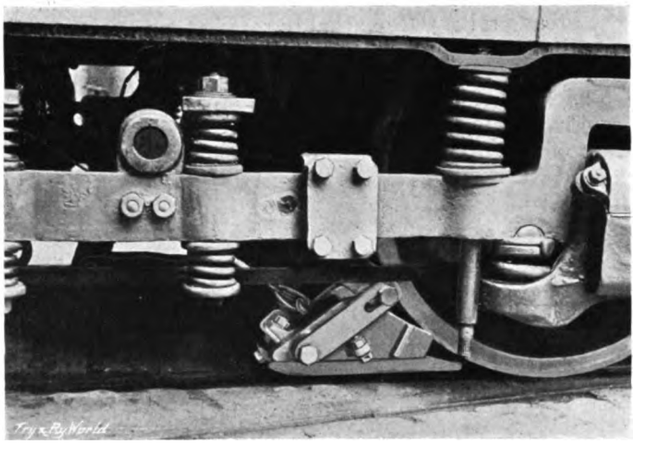

Fig. 2.—Brake Out of Action.

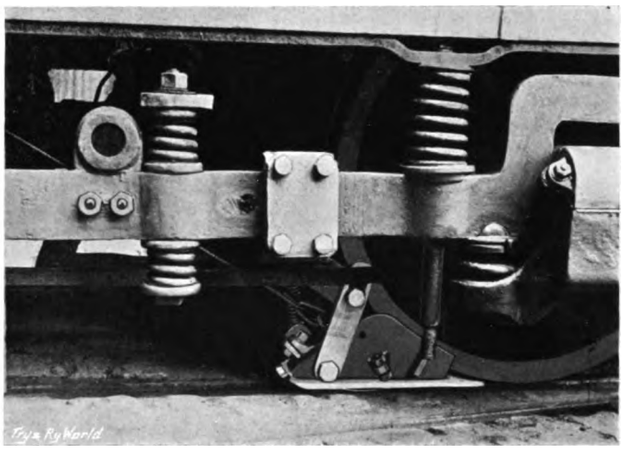

Fig. 3.—Brake Applied.

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To lift the brake-block after application the lever M is raised until it engages with the lever L. The catch N then falls into position and holds the lever L in place. When the steel wire is pulled for lifting, it causes the block to swivel on centre F and forces the taper end of the skid-bar against the wheel flange. On lifting further an adjustable set-screw H will come in contact with the link, and the block will then be entirely raised from the centre E, and this will cause the tapered end of C to stand clear of the flange, and the brake-block will then come to its normal position ready for application. It may here be noted that any failure of the connecting gear between the operating handle and the brake-block causes the brakes to be applied.

A number of tests have been carried out during the past month in the presence of tramway engineers and managers, representatives of the Brakes Committees of the two Tramway Associations and of the technical press, and all of these tests have given very satisfactory results. Particulars of specimen tests are appended, so that the reader may form his own opinion of the contribution which Mr. Pringle has made to the most urgent problem which confronts tramway managers to-day.

The car used for the tests was an ordinary top-deck car mounted on a Brill single truck, and equipped with two 25 H.P. Dick-Kerr motors. By the courtesy of Mr. James Toulmin, engineer and manager of the Burton and Ashby Light Railway, the tests recorded below were carried out on a straight section of that line in Hill Street, Swadlincote, where the gradient is 1 in 12. The tests on April 6 and 9 were made on the same section, and as the tests proceeded the rail groove became burnished where the skid was bearing, so that the later tests were not made with the normal rusty surface of the groove. No sand was used in any test.

Date.	Position.	Grade.	State of Tread.	State of Groove.	Speed Miles per Hour.	Stop in ft.		Stop in sec.	Retard in ft. per sec. per sec.
						ft.	in.		
April 6	Hill Street, Swadlincote	1 in 12	Dry and clean	Damp and washed clean by heavy rain in night	13	38	6	—	—
"	"	"	"	"	18	62	0	5	5·27
"	"	"	"	"	24	157	0	6⅝	5·46
"	"	"	"	"	16	66	6	—	—
"	"	"	"	"	13	75	0	—	—
"	"	"	"	"	21	128	0	—	—
"	"	"	"	"	4½	2	0	—	—
"	"	"	"	"	7	12	3	—	—
"	"	"	"	"	10½	24	0	—	—
April 9	"	"	"	Dry and quite clean	12¾	32	6	3⅜	5·18
"	"	"	"	"	18	84	0	5½	5·05
"	"	"	"	"	23	165	0	8¼	3·91
"	"	"	"	"	15	65	6	5	4·38
"	"	"	"	"	18	66	0	5¼	4·53
"	"	"	"	"	4½	3	9	⅜	8·22
"	"	"	"	"	7	11	6	2⅜	4·27
"	"	"	"	"	10⅝	40	0	4	3·88
"	"	"	"	"	10½	34	3	2⅝	5·46
"	"	"	"	"	10½	59	0	5⅜	2·84
"	"	"	"	"	10	28	0	—	—
April 15	Ashby Road	Level	Dry	About half-filled with dry dirt	4½	1	2	⅜	20·0
"	"	"	"	"	4½	1	10	½	20·0
"	"	"	"	"	7¼	5	4	⅝	17·7
"	"	"	"	"	7	6	4	⅝	17·0
"	"	"	"	"	9½	11	4	1⅛	11·6
"	"	"	"	"	9¾	12	4	—	—
"	"	"	"	"	10	13	10	1⅛	12·15
"	"	"	"	"	12	21	9	⅞	7·95
"	"	"	"	"	12¾	28	4	—	—
"	"	"	"	"	13	29	5	—	—
"	"	"	"	"	13	29	4	2⅜	7·9
"	High Bank Road	1 in 70	"	"	16	36	6	3¼	7·2
"	"	"	"	"	16	38	0	3¼	7·2

The Pringle brake has been used experimentally for some time on one of the cars on the Burton-on-Trent Corporation tramways, and the photographs show the brake-gear on this car. Fig. 2 shows the brake out of action. In Fig. 3 the brake has been applied, the skid has engaged the groove and the wheel is between the guides. The changes of the position of the spring and links will be clearly seen. In the earlier form the brake was inspected on behalf of the Board of Trade, and its use was approved on July 3, 1907, on six of the cars running over a route having a gradient of 1 in 11·7. Since that time considerable improvements have been made, and the Board of Trade desire to make a further inspection of it.

We understand that the manufacturing rights of this brake have been acquired by Messrs. Mountain and Gibson, of Bury, and that the brake will be very shortly placed on the market.

VOSS' SLIPPER AND EMERGENCY BRAKE.

The brake invented by Mr. Thomas Voss can be used as an ordinary slipper brake applied from the platforms by a wheel, and also as an emergency brake independent of the ordinary hand slipper brake; this is easily effected by the mere pulling over of a lever at either end of the car. It can readily be fixed to trucks without drilling or weakening them. By permission of the Birkenhead Corporation Tramways Committee the apparatus has been tested on a car belonging to the Dundee Corporation Tramways Committee. The tests were on a grade of 1 in 15, and the car was brought to a standstill, whilst travelling at ten miles an hour, in 41 ft. On a grade of 1 in 13, after the driver was supposed to have lost control of the car by the hand brake, and to have realised that there was no other means of stopping the car, the emergency brake was then applied, and the car was pulled up in 38 ft. Whilst travelling at eight miles an hour on a level track the car was pulled up in half its own length. Moreover, the driver, or conductor, or passengers if needs be, can apply the brake by merely pulling over the lever at either end of the car; further, it is claimed that, by applying brakes to the rear part of the car, the tendency is to pull up the car in a shorter distance than by other means.

The apparatus consists of two shafts of great strength carried on either side of the truck. The ends of the shafts are fitted with cams, and inside with gear wheels and running sprocket wheels, with sprocket chains continually running round free. The driving power is obtained from a sprocket wheel fixed on the inside of the running wheel, which does not necessitate any drilling of holes, as it is made in halves, and can be easily fitted to the truck wheels. A connection is made by an endless chain which is continually running, and the moment the brake is applied it revolves the rear shaft by the gear reversing the front shaft, so that there are two cams applied with a down pressure on to brake blocks and on to the track. It is instantaneous in its action, and the power that is obtained by the wheels applying it is so effectual that the result is as stated; but even better results are expected after certain improvements have been tried. As the application of the brake affects the truck and not the car body, it was found on the trials that the shock was very slight, in fact it was not so great as when the driver applied the ordinary hand brake.

Further and thorough tests of the car are to be made shortly both at Birkenhead and on the Dundee gradients, which are very severe, and, it is expected, with even more satisfactory results.

St. Petersburg Projects.—Great numbers of proposals for the construction of new electric tramways continue to pour into the offices of the St. Petersburg Town Council, says a local newspaper correspondent. Thus an engineer, Mr. Tavurno, proposes to construct an overhead line along the Ekaterininsk canal, whilst Mr. Bernatovitch proposes to construct an electric railway along the bed of the canal in question. Mr. Leschern von Hertzfeldt offers to construct an electric railway from the Finland Station to the Baltic Station. The Siemens and Halske Company have prepared a project for the construction of an underground railway for St. Petersburg.

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THE
Tramway and Railway World

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We shall be pleased to receive at all times articles, papers, notes, and correspondence on subjects of interest to those concerned in the financial administration, construction, or management of tramway and light railway undertakings. Particulars as to the issue of specifications, the progress and completion of contracts for new work, and suggestions for improvements in all branches of tramway enterprise will receive special attention.

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LONDON, MAY 7, 1908.

Foreign v. British Rails.

The well-founded complaint which was made two years ago of the action of the then London County Council in awarding a contract to foreign rail-makers, under conditions unfair to the home manufacturer, has perhaps faded largely out of memory, but an echo of it was heard at a recent meeting. This echo apparently is the last that will be heard of the subject. It may be recalled that the Council accepted a tender for foreign rails because it was the lowest, while at the same time the conditions of the contract provided for the payment of trade union rates of wages to the workmen and the observance of trade union hours of labour. These conditions were enforceable on British manufacturers, but could not well be enforced on the foreigner. Even if enforced in the latter case, it was generally accepted that the recognised wages were lower, and the hours of labour longer on the Continent than in this country. The injustice to the home manufacturer was so plain that the Council requested the Highways Committee to ascertain and report as to wages, hours, Sunday labour, and mining royalties in connection with rail manufacture on the Continent. Whether the Committee ever made an adequate report is doubtful; for nothing was communicated to the Council, and all attempts to obtain publicity for the proceedings of the Committee failed. During the past month the present Highways Committee, which is differently constituted from that which received the commission, referred to the subject in a report to the Council. From this statement it appears that soon after the remit was made information was collected, but it was "incomplete." The Committee are now advised that it would not be possible, without a further extensive inquiry, to complete the information, and it was recommended that no further action should be taken. This course was adopted, and probably after the time which has elapsed little good would now be done if the Committee pursued the subject. For the present at all events the object in view has been attained, as no more foreign tenders for rails are being accepted. It is clear that none should ever be accepted unless the Council abolish the restrictions on contractors as to wages and hours of labour. These restrictions for the present at all events remain in full force.

Trolley Omnibuses.

If a new movement towards the adoption of what are sometimes called trackless trolley cars were now to take shape, the circumstance would be peculiar and interesting. It is some years since proposals were first mooted in this country for running electric omnibuses by means of current obtained from overhead trolley wires, as in the case of a tramway. In fact, a bill was—if we remember aright—passed by Parliament to enable a company to run 'buses of the sort, but nothing has been done. The petrol engine came along, and there were great expectations—not yet realised—of the automobile 'bus, which would be free to run on any road, instead of being confined to those equipped with overhead wires. As, however, the petrol system has not so far proved very successful commercially, it appears that in some quarters attention is again being turned to the trolley 'bus. In Germany there are several installations of the kind which are reported to be successful, and the point emphasised is that they can more than pay their way on routes where the volume of traffic is so small that a tramway is impracticable. The

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capital cost of overhead equipment and of the electric 'buses themselves is small, and the working expenses per car mile will be similar to those of an electric tramcar. Though the traction resistance on an ordinary road is greater than on rails, the vehicles may be smaller and lighter than tramcars, and on country routes the driver could also act as conductor. From an investigation recently made by the manager of the Dundee tramways, it appears that the trolley omnibus system can now be worked for less than 5d. per car mile. It is evident that this estimate does not contemplate the use of india-rubber tyres on the vehicles; but with iron tyres the figure is quite possible, especially if there are no conductor's wages to pay. It is very doubtful, however, whether permission would be given to use iron tyres, and even if so, then a substantial contribution to road maintenance would be asked. The trolley 'bus has also been recommended to York Corporation in preference to tramways. We see no reason why such a system should not be useful temporarily in districts where there is not sufficient traffic to justify the immediate construction of tramways. Practically all the elements of expense—capital and working—are well known, so that there need be little uncertainty about such a venture.

Light Railways and Small Holdings.

History is strewn with examples of laws which have had an effect very different from what their framers intended. There could hardly, however, be any more striking instance of this fact than the Light Railways Act, 1896. The original intention of that measure was to facilitate the construction of light railways which would assist the development of agricultural and fishing industries. But the extent to which the Act has been used for that purpose is a mere trifle compared with the use which has been made of it for electric tramways. There was no intention to make the Act a substitute for the Tramways Act, 1870; but such a substitute was badly needed, and promoters seized upon the opening offered by the new Act. The consequence has been that a large mileage of electric tramways has been constructed under the Light Railways Act which has, in turn, been interpreted in the spirit of the Tramways Act. By this means the original function of the Light Railways Act has been overshadowed; and now, when there is something approaching a cessation of electric tramway enterprise, that original function has been almost forgotten. It is, therefore, quite to the purpose for Mr. Rigg to raise—as he has done in the columns of the *Financial Times*—the question whether an effort should not be made to put the Act into practice in connection with the agricultural developments which the present Government is fostering. The latest phase of the "Back to the Land" movement is the encouragement of small holdings; the idea is to create a large class of peasant proprietors who will grow produce for their own consumption, but mainly for marketing. It is obvious that the success of this policy depends greatly upon the access afforded to suitable markets; and it is in this connection that the construction of light railways is urged by Mr. Rigg. He argues that something might have already been done by private enterprise (this is a speculative business as yet beyond the scope of rural local authorities) to provide transport facilities which would be of value to agricultural districts, had not the restrictions and obstacles imposed upon light railway development proved so discouraging. Owing to the meagreness of the traffic which can, even in the most favourable circumstances, be expected from a rural or semi-rural light railway, it is essential that capital expenditure should be kept at the lowest level. The costs of promotion should not be swelled by the necessity of employing counsel to deal with purely factious opposition; the cost of obtaining land should be reduced; and a much lower standard of construction should be permitted than in the case of the ordinary tramway. There is a healthy prejudice in this country against a "cheap job," but in this case it is a question of a cheap job or none at all. We doubt very much, on the other hand, whether private enterprise will be attracted to this somewhat scanty field for a long time to come. The field is eminently one for the co-operation of private and State enterprise, regarding which Mr. Lloyd George has spoken with earnest enthusiasm. The Light Railways Act provides the machinery for State assistance, though not perhaps in the form best calculated to promote the extension of light railways in

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connection with small holdings. However, the Government has not scrupled to lend its credit for the development of small holdings, and it should not, therefore, hesitate to give a similar assistance to so important an adjunct as agricultural light railways. The Light Railway Commission might well employ their rather vacant days in giving the world the benefit of their intimate knowledge of the situation, by suggesting the districts in which a co-operative light railway scheme might be carried out. We feel sure that no one would object to the Commission taking the leading part in this matter.

Creosoted Paving.

It is probable that the important case of West *v.* the Bristol Tramways and Carriage Company has now been finally disposed of, and it behoves all tramway owners to take note of the decision of the Court of Appeal. The action was brought by a market gardener to recover damages for injury alleged to be caused to his plants by fumes or dust from creosoted wood paving laid down by the tramway company in a street passing the plaintiff's grounds. In the local Court, on certain findings by a jury, judgment was entered for the plaintiff, aud this decision was upheld by the King's Bench Division, and finally by the Court of Appeal. There is a statutory obligation on the company to pave their tramway tracks with wood blocks, and they, therefore, contended that they were not liable for any damage that might be done merely because the blocks were creosoted, especially as no previous case was known of the creosote doing any harm. The Court of Appeal has held that as the statutory obligation is not to pave with creosoted wood, but simply with wood, the company are liable for damage caused by the creosote. It was the jury who found that the injury complained of was caused by the creosote, and the higher Courts did not go beyond that finding. It will now be open for any tenant of land on which plants and shrubs are grown, and which is contiguous to tramways paved with creosoted wood, to aver that any languishing condition of his botanical treasures is due to the creosote, and it may well be that other juries will decide in his favour. As a rule it will, we believe, be found that the tramway authority has no specific statutory power to use creosoted wood, and so liability is likely to be incurred. In view of general experience, probably the best course is to have the subject scientifically investigated, as never before have averments of fumes from wood paving killing plants been brought forward. The Bristol circumstances as to weather and season of the year appear to have been somewhat exceptional, but there is abundant evidence from other towns of creosoted paving being quite harmless to adjacent vegetation. This fact ought to be put on a firm basis, if possible, by a scientific inquiry.

Electric Locomotive Design.

The new electric locomotive, illustrated elsewhere in this issue, embodies several points of interest. Chief of these is, perhaps, the high centre of gravity. Mr. Kelly is, we believe, the first to call attention to this point, which demands more thought than it has yet received. With motors suspended from the axle, and directly geared thereto, the centre of gravity is necessarily low, and the dead weight on the axle considerable. This is accentuated in gearless locomotives in which the armature is built upon the axle, and is largely responsible for excessive wear on rails and flanges, and for increased risk of derailment, as witness the case of the New York Central locomotive. It is worthy of note that no parallel to these conditions exists in steam-locomotive practice where the centre of gravity of the machine is far higher above rail level. Indeed, the disadvantages of a low centre of gravity were clearly demonstrated in the case of a steam locomotive built by the London and North Western Railway Company many years ago, in which the boiler was placed below the driving axle. The results were unfavourable, and the design was abandoned. In the present instance the locomotive is specially designed for large tractive effort at low speeds and, although the height of the centre of gravity is not of so much importance under this condition, it is, nevertheless, well worthy of emphasis, and will have a material effect in promoting easy and safe riding, and in reducing the cost of maintenance.

THE SANDBERG RAIL.—Messrs. Mordey and Dawbarn, consulting engineers for the City of Santos Improvements Company, have ordered the rails required for the lines of this company of Sandberg's improved rail steel. The Leeds City tramways, the Manchester Corporation tramways, and the Bradford Corporation tramways have also recently contracted for tramway rails of Sandberg's improved rail steel.

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THE PECKHAM RADIAL TRUCK.

Peckham's radial truck, which is fitted to one of the cars on West Ham Corporation tramways, has now been in use for three months, and is reported to be giving much satisfaction. This form of truck, which is one of Mr. Edgar Peckham's most recent designs, embodies several features of interest. It includes the principle of Peckham's pendulum gear with the radial gear in addition.

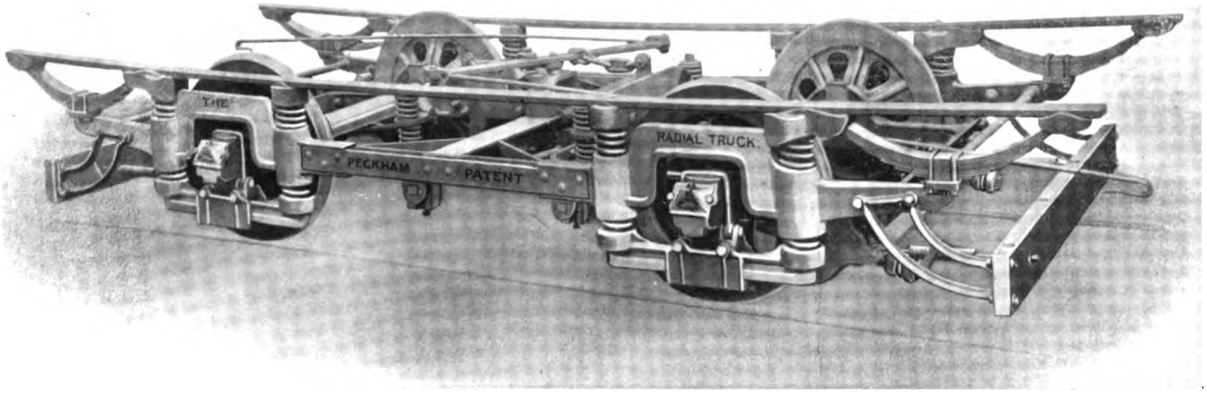
The pendulum gear consists of a swing link resting in a groove in the top of the axle box, and connected to a horizontal bar or frame underneath the axle box. This horizontal bar is provided with spiral springs for supporting the car body. Its construction is such that the car body is flexibly supported upon the axle boxes, which are free to move laterally independent of the body or truck. This flexible support cushions the side thrusts of the body on the wheel flanges on curves, and also relieves the body from side motions produced by a rigid gear on an uneven road bed.

The spiral supporting springs of this gear, being located at each side of the axle box, give additional support to the end extensions of the truck frames, increase the effective wheel-base of the truck 2 ft. 6 in., and prevent oscillation of body.

The radial truck, fitted with the pendulum gear, has an effective radial action. This is accomplished by connecting the link projecting downwards between the axle box and the horizontal bar or spring plank to a roller box or casing that surrounds the horizontal bar on three sides and is provided with a series of rollers upon which the horizontal bar is supported, and also by enlarging the width of the pedestal or yoke of the main frame, so that the axle box can move the required distance when on a curve.

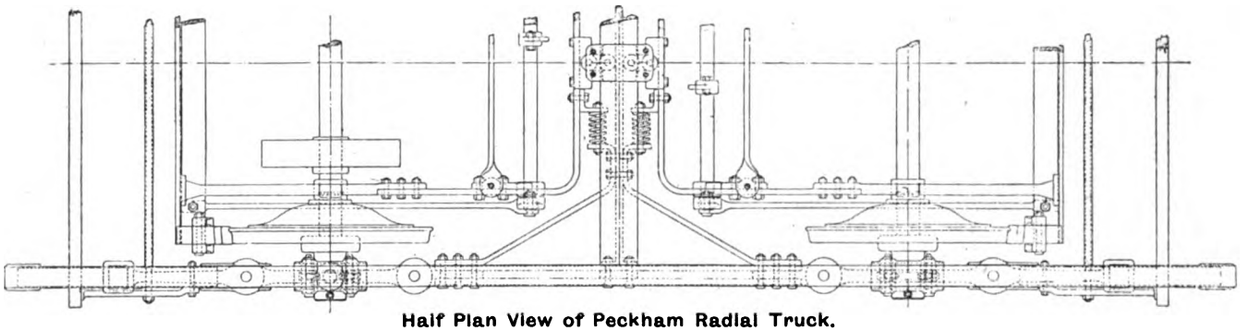
The wheels and axles are equipped with a frame centrally connected by flexible links to a cross member of the main frame. These links permit the auxiliary frame and the motors and brake mechanism supported by it to move laterally when on curves, so as to relieve the pressure on the radial gear.

It is claimed for this truck that it radiates perfectly on the shortest curves, and comes back to the straight as soon as it leaves the curve. The centre connecting links of the motor sub-trucks adjust themselves to the various conditions of the rails, and relieve the motors and car body of side thrusts and shocks. The trucks can be made of any desired wheel-base, and adapted to any length of car body. For tramway cars the wheel-base varies from 7 ft. 6 in. to 10 ft. As a result of these advantages, great economies in maintenance are anticipated.



The Peckham Radial Truck.

The accompanying illustrations give a very good idea of the truck, which is manufactured under the supervision of Mr. Peckham by the Magnolia Anti-Friction Metal Company of Great Britain, 49, Queen Victoria Street, London.



Half Plan View of Peckham Radial Truck.

ELECTRIFICATION OF THE HEYSHAM LINE.

The Midland Railway has just inaugurated electric traction on part of its electrified lines, the electrical working being for the present confined to the Morecambe and Heysham branch. The full scheme, which includes the conversion of the line as far as Lancaster, will not be completed for some time. The trains are composed of three cars—a motor-coach accommodating 75 seated passengers and two trailer cars with 56 seats in each. The capacity per train is about 220 passengers. The Morecambe-Heysham line enjoys the distinction of being the first railway in England to be worked on the single-phase system, which has also been adopted by the Brighton for its South London electrification, which is now in progress. The current is distributed by means of overhead transmission, thus doing away with the customary "live" rail.

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A NEW ELECTRIC LOCOMOTIVE.

By A. C. Kelly, Assoc.M.Inst.C.E.

Electric locomotives for slow speed haulage on mineral railways, and for use in other places where large tractive efforts are required at moderate speeds, have hitherto been constructed more or less on the lines of tramway practice, that is, with direct-current motors geared by single reduction gearing to the driving axles. When, as is usually the case, these locomotives have to run on narrow gauges, the difficulties of making a really satisfactory locomotive are considerably increased, since the space available for the motors between the wheels becomes very restricted.

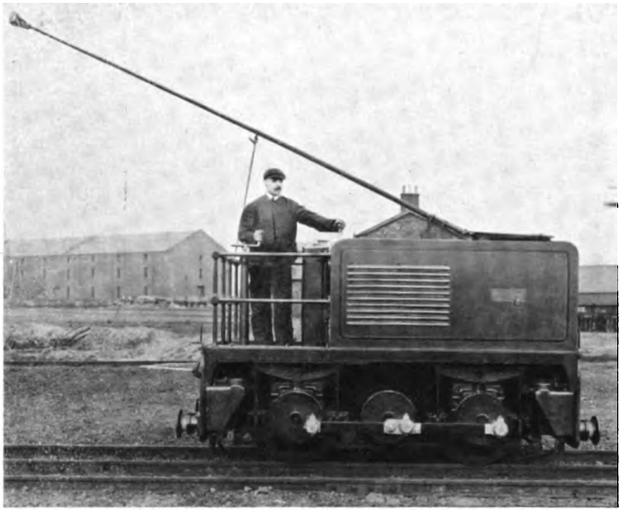
The locomotive shown in the illustration has been designed especially for use on a 30 in. gauge mineral railway. It contains a single direct-current, series-wound motor geared, by double reduction gearing, to a countershaft placed between the axles. Both the countershaft and the axles are provided with crank discs, and the former drives the latter by coupling rods. The principal advantages of this construction are as follows:

(1) By the use of double-reduction gearing the motor may be run at conveniently high speeds, whilst the speed of the locomotive is kept within the ordinary requirements of this class of work.

(2) The motor, being placed on the deck of the locomotive, is accessible from all sides, and can overhang the wheels of the locomotive. This permits far larger motors to be used than has hitherto been possible.

(3) The whole of the locomotive, with the exception of the wheels and axles only, is completely spring supported. This ensures easy riding even on a light permanent way.

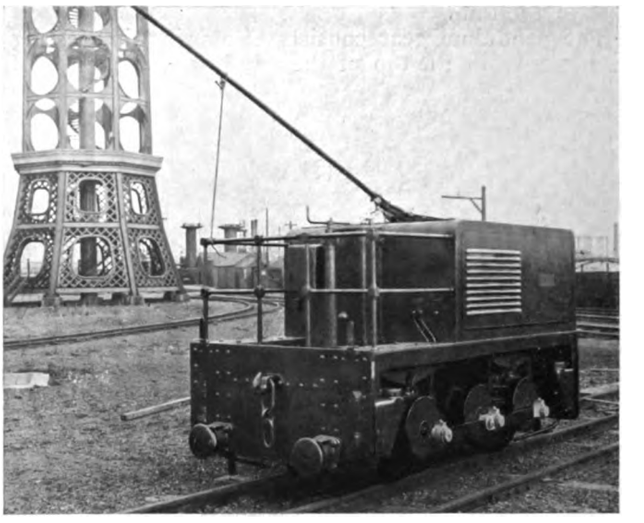
(4) The centre of gravity of the locomotive is higher than usual, thus improving the riding properties of



Electric Locomotive for 30 in. Gauge Mineral Railway.

the machine and reducing the cost of upkeep and maintenance. A heavy machine with low centre of gravity subjects the permanent way, and the locomotive itself, to severe shocks and vibration. The following are the principal particulars of this locomotive—Class: Four-coupled, slow speed, narrow gauge; weight in working order, 11 tons; gauge, 2 ft. 6 in.; wheel-base, 5 ft.; diameter of wheels, 33 in. The electrical equipment consists of one 95 H.P. 500-volt, direct-current motor. At full load the speed is six miles per hour, and the maximum speed 20 miles per hour. The tractive effort at six miles per hour is 5,000 lb., and the maximum tractive effort is 6,500 lb. With favourable conditions of rail, even greater tractive efforts than the above have been developed, and this locomotive has easily started and pulled a train of coal wagons totalling 150 tons.

The locomotive has been designed and constructed by the British Westinghouse Electric and Manufac-



End View of Electric Locomotive.

turing Company, Limited, Manchester, and will shortly be at work on the Oakbank Oil Company's private railway at Mid-Calder. This is the third Westinghouse locomotive supplied to this company, the first two having been of 50 H.P. each, with single reduction geared motors.

The Iron and Steel Institute.—The annual meeting of the Institute will be held at the Institution of Civil Engineers, Great George Street, Westminster, on May 14 and 15. The annual dinner will be held in the Grand Hall, Hotel Cecil, on Thursday, May 14, under the presidency of Sir Hugh Bell, Bart.

New Dutch Electric Railway.—A concession has been granted by the Dutch Government to the Amsterdam and North Holland Electric Tramway Company to construct and operate a system of electric railways in Holland. The system comprises about 50 kilometres of route, running from Amsterdam North through Zaandam to Krommenie, from Zaandyk to Wyk-aan-Zee, and Wormerveer to Purmerend. The Amsterdam and North Holland Electric Tramway Company has entered into a contract with the Holland Development Company, 278, Heerengracht, Amsterdam, to construct the entire system.

A New Time Recorder.—A new time recorder, of a similar type to the well-known Rochester card recorder, but which automatically prints the punctual arrival of employees at their work in one colour and the late arrivals in a different colour, has just been put on the market. By this machine all irregular times in the week's card are seen at a glance, which of course effects a great saving of the time of both the time and cost clerks, as well as providing further protection against fraud on the part of employees. The new recorder has been devised by the International Time Recording Company, 151-155, City Road, London, E.C.

Rural Repopulation.—An example of the effect of light railways in bringing the people back to the land in rural districts came before the Western Highways Committee of Norfolk County Council at a meeting on April 22. Mr. A. J. Keeble, of Wareham, in making an application for liberty to carry a light railway across a main road, stated that he had five miles of rails on his estate. Prior to his development of the land the estate was barren fen, but the laying down of the line had been very successful, and had brought six hundred people back to the land. Before he developed the estate one-third of the cottages in the district were empty, but now it was a matter of difficulty to get one.

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SERIOUS ACCIDENT AT BOURNEMOUTH.

One of the most serious tramway accidents which has ever happened in the United Kingdom occurred at Bournemouth on May 1, when seven persons were killed and seventeen injured. A car belonging to Bournemouth Corporation was proceeding along part of the through route between Bournemouth and Christchurch. The car, which has seating accommodation for some 60 passengers, had about 40 on board at the time. It was on its way from Poole to Pokesdown, and at Poole Hill it made the usual change from the overhead wire to the conduit connection at the point where these two systems meet. There are several sharp descents from this place by way of Poole Hill, the Triangle, and Avenue Road to the Square, and as these are accompanied by two or three curves the gradient has to be taken at moderate speed. Soon after the car left the change-over place it began to run faster than usual. The driver, W. Wilton, tried to check the speed by the brakes, but his efforts were unavailing, and the car rushed along at ever-increasing speed. It got round two curves safely, but on reaching a bend at Fairlight Glen it left the metals, rushed across the road, crashed through an iron railing, and fell into a wooded hollow some 15 or 20 feet below. The outside passengers were thrown off with great violence, some of them striking the trees and being caught in the branches, while the inside passengers were crushed together equally violently. Four passengers were killed instantly, and three others died soon afterwards. The driver, Wilton, suffered severe injury to his back, but the conductor, P. Finch, was only slightly hurt. Inspector Sellars, who boarded the car at the top of the hill, also escaped lightly. There was no lack of speedy aid, and everything possible was done for the sufferers.

The Town Council held a special meeting on May 2, when a resolution was passed condoling with the friends of those who had lost their lives, and expressing sincere wishes for the recovery of the injured. Telegrams of sympathy were received from the heads of tramway undertakings throughout the country.

Major Pringle, of the Board of Trade, after visiting the scene of the accident, opened an inquiry as to the cause on May 4. Mr. G. W. Bailey, town clerk, said that the Town Council, since the starting of the tramways, had done their utmost to prevent accidents. The system had been in existence four and a half years, and no serious casualty had happened, which went a long way to show that due care, so far, had taken place. Acting under the advice of the Board of Trade, all cars traversing the Avenue Road route had been specially fitted with magnetic brakes, in addition to other brake appliances. This particular car had made the journey several times during the day, but nothing untoward had happened until the evening, when the accident occurred.

Several members of the public who saw the car running down the hill gave evidence, and their estimates as to the speed attained varied widely. It appeared that the maximum regulation speed down the gradient was six miles an hour, and one or two witnesses said that occasionally they saw cars going faster than usual. Two passengers on the car gave their estimates of speed.

Dr. Spink said that he saw the driver directly after the accident. He was perfectly sober, but naturally pale and distressed. He remarked "I stuck to her as long as I could."

Mr. Cecil Barber, engineer and traffic manager to the Corporation, said that conductors were selected by himself from applicants residing in the district. They were sent out on the road with another conductor, with whom they stayed to learn the routine. A man was not put in charge of a car until he had satisfied the chief inspector. When a suitable man wished to become a driver he went out with a selected driver, and during that time he was instructed by the driver in the handling of a car. The chief inspector instructed the man on different matters—such as what was to do done in an emergency, the number of points to be watched, and the care to be taken. A month would probably be the minimum time for instruction. The driver, Wilton, who was in charge of the car which was wrecked, became a driver in 1904. His general character was good. He was very steady, and one of the best men they had. The car was capable of carrying 64 passengers and was built in 1905.

The inquiry was continued on May 5, when the first witness was Mr. F. W. Lacey, borough engineer. Mr. Lacy said that the tramway line was constructed in 1904, but the curve where the accident happened had since then been practically relaid. The super-elevation of the outer rail varied from a quarter of an inch to one inch, and at the spot at which the car left the lines it was three-quarters of an inch. If the car was travelling at 15 or 16 miles an hour, as one witness had stated, the super-elevation for safety would have to be six or seven inches. He did not think it was possible to give more super-elevation than at present existed. The flanges of the car wheels were in good condition.

Mr. I. Bulfin, electrical engineer to the corporation, stated that he had examined the brakes on the car and had found them satisfactory. He believed that the driver reversed the power, and thus rendered the magnetic brakes inoperative.

Mr. C. Barber, who was recalled, said that the car was fitted with three brakes; the hand brake brought blocks to bear on eight wheels. The magnetic brake would not act if the wheels were not turning. On examining the car after the accident he found that the hand brake blocks were jammed tightly on the eight wheels. The brake gear was in a thoroughly satisfactory condition, and there was no loose movement. The reverse lever was in the opposite direction from that in which the car was running.

Major Pringle: Were the magnetic brake and the brake shoes working at the time?—From the position of the handles they could not have been. The hand brake was the only brake that was on. The near left hand magnetic shoe was broken.

Was it broken by the action of the car on Friday?—No.

Why was the car sent out with a broken shoe?—It had broken down a short time before. It was disconnected in order to allow the three other shoes to work. There had been an electrical failure in the insulation.

Why was the car not fitted with a new brake shoe?—At that time there was no immediate opportunity of replacing it, and the other three shoes were absolutely sufficient.

Then you allow the car to go out on service with three out of the four magnetic shoes in use?—Yes, on certain conditions.

On this car on Friday there was evidently in use only the hand brake, with the possibility of using the reverse or controlling lever?—I think so. Answering further questions, Mr. Barber said that the car was last in the workshop in December, 1907. There was a superficial examination made of the cars each night. He had known of one case in August, 1906, when a car ran away down the same incline. It was the same car as had met with the present accident, but it was not the same driver. On that occasion the driver used his reverse power and stopped in the straight road before reaching the Avenue.

Replying to questions by the Town Clerk, Mr. Barber said that the reason why one shoe of the magnetic brake was disconnected was to allow the other two shoes to be worked. The three were in good order. He was absolutely convinced of that, as half-an-hour before the accident he saw this car going down Constitution Hill when the brakes were acting splendidly.

Major Pringle: And the absence of the fourth?—Has nothing to do with it whatever.

Mr. William B. Lait, depôt superintendent, stated that he examined the car soon after the accident, and he found the reversing barrel of the rear controller was in the wrong position, and this would upset the magnetic brake. He did not realise at the time that this was a serious matter. The position of the barrel of the rear controller was not due to the car falling over the bank. The witness showed some hesitation in giving replies to questions as to his knowledge of the particular car, which led Major Pringle to say, "Do let somebody get into the chair and tell me straightforwardly what happened."

William Rush, divisional inspector, stated that this car, No. 72, was on May 1 brought to Parkstone depôt with the controller defective at No. 2 end.

Major Pringle: That is the end where the defect was discovered on Friday night.

The witness continued that later in the day the controller was put right and the car was sent out again.

William Robinson, an employee at the central depôt, said that the magnetic brake of the car was defective on April 28. He examined and adjusted it. If the controller was in the same position on Friday as it was when he discovered it on April 28, the magnetic brake would have been useless. The condition of the blocks and brakes on the car was satisfactory in the event of the electric current acting properly.

Henry Tallboys, a fitter at the Parkstone depôt, said that the controllers on the cars were examined twice a week. He examined sixteen cars nightly.

Several other employees, including fitters, gave evidence, and Major Pringle said that it was a serious point that those men were not responsible for any particular car.

James Bartlett, a car driver, stated that he drove car No. 72 up to 1-14 o'clock on May 1. He went down Poole Hill three times. The hand brake was satisfactory, and he used the magnetic brake frequently. He believed that all the shoes were working.

John Copeman, driver, said that he took charge of car 72 at 1-15 on Friday, May 1, and at three o'clock No. 1 end controller went wrong. The car was taken back to the depôt, where witness explained what was wrong, and was given another car.

Three other drivers gave evidence of the fact that they had had charge of car 72 for a short time on Friday, and found nothing wrong with the brakes.

Inspector Sellers, who was on the car when the accident occurred, said that he did not think the wheels skidded at any part of the journey. The driver was sober.

Conductor Finch, who was in charge of the car at the time the accident happened, said that he noticed nothing wrong when they left Poole. He thought the car went off the track at a speed of 25 miles an hour. He did not apply the brake at his end as it was not his duty to do so until he received a signal from the driver. That signal was not given.

The inquiry was adjourned to a future date in order to enable driver Wilton, who was injured, to give evidence.

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LONDON COUNTY COUNCIL TRAMWAY MATTERS.

At a meeting of London County Council on March 31, the Highways Committee reported on tenders received for the

Reconstruction of Brixton to Camberwell Tramways.

The tenders were (1) for the road work, exclusive of rails and special track work, for reconstruction on the trolley wire system; and (2) certain paving works outside the tramway tracks for street widenings. The total length of line was 2½ miles, reckoned as single track. The following were the tenders:

	Tramway Works.			Paving Works for Street Widenings.			Total.		
	£	s.	d.	£	s.	d.	£	s.	d.
W. Manders	17,091	5	11	2,185	2	1	19,276	8	0
R. W. Blackwell and Co. ...	17,997	15	0	2,341	17	2	20,339	12	2
W. Underwood and Bro. ...	18,176	16	3	2,206	1	5	20,382	17	8
G. Law	18,367	11	1	2,144	8	0	20,511	19	1
Dick, Kerr and Co.	18,597	2	9	2,272	16	3	20,869	19	0
J. Mowlem and Co.	18,970	9	11	2,549	12	3	21,520	2	2
Fry Bros.	19,280	1	7	2,515	2	0	21,795	3	7
W. Muirhead and Co. ...	19,723	0	5	2,585	7	1	22,308	7	6
R. C. Brebner	20,242	5	2	2,636	16	5	22,879	1	7
W. Griffiths and Co., Ltd. ...	20,303	19	0	3,037	6	9	23,341	5	9
Thos. Doney	23,431	2	0	2,492	17	6	25,923	19	6

The chief engineer's estimates were £18,362 7s. for tramway works, and £2,515 15s. for street improvement works, or a total of £20,878 2s. The Committee recommended that the lowest tender, namely, that of Mr. W. Manders, should be accepted, and that he should be allowed to sub-let to the undermentioned firms the following portions of the work: (1) Improved Wood Pavement Company, wood paving; (2) Associated Portland Cement Mauufacturers, cement; (3) Lahmeyer Electrical Company, bonds; (4) Hadfield's Steel Foundry Company, drain boxes; (5) Bayliss, Jones, and Bayliss, tie bars, bolts, etc.

The recommendation was confirmed.

Electric Cable Contracts.

The Committee had considered the following tenders for the manufacture, delivery, and laying of high-tension cables, and low-tension and telephone cables.

High-tension Electric Cables, etc.

	£	s.	d.
British Insulated and Helsby Cables, Ltd.	32,000	3	11
Siemens Bros. and Co., Ltd.	32,487	4	10
Western Electric Co., Ltd....	32,580	14	8
Callender's Cable and Construction Co., Ltd....	32,918	16	2
W. T. Henley's Telegraph Works Co., Ltd.	32,202	13	0
W. T. Glover and Co., Ltd.	33,648	15	7
Johnson and Phillips, Ltd.	33,922	10	8

Low-tension Electric Cables and Telephone Cables, etc.

	£	s.	d.
W. T. Henley's Telegraph Works Co., Ltd.	35,101	4	7
Union Cable Co., Ltd.	36,085	2	2
British Insulated and Helsby Cables, Ltd.	36,349	9	10
Siemens Bros. and Co., Ltd.	36,918	11	1
Johnson and Phillips, Ltd.	36,955	11	8
Western Electric Co.	37,059	0	0
W. T. Glover and Co., Ltd.	38,546	13	6
Callender's Cable and Construction Co.. Ltd....	38 745	11	3

The Committee recommended that the lowest tender in each case, namely, that of the British Insulated and Helsby Cables for the high-tension cables, and that of W. T. Henley's Telegraph Works Company for the low-tension and telephone cables, should be accepted.

The proposals were adopted.

Contract for Piping.

The following tenders had been considered by the Committee for the supply of the steam, exhaust, feed, drain, and condenser piping and valves, water-tanks, etc., required for the second portion of the Greenwich power-station:

	£	s.	d.
John Spencer, Ltd.	10,910	13	10
James Cakes and Co.	11,265	5	5
S. Russell and Sons	11,737	4	0
Babcock and Wilcox, Ltd.	12,453	0	0
Jones and Co., London	12,589	18	6
Railway and General Engineering Co., Ltd.	12,918	19	0
Stewarts and Lloyds, Ltd.	13,175	17	9
John Wilson and Co....	13,443	1	1

The estimate of the chief officer of tramways was £14,250. The Committee recommended, and the Council agreed, that the lowest tender, namely, that of John Spencer, Limited, should be accepted, and that that firm be allowed to sub-let parts of the work as under: (1) T. Piggott and Company, Limited, riveted steel pipes; (2) James Oakes and Company, Appleby and Company, or Staveley Coal and Iron Company, cast iron pipes; (3) S. Russell and Sons, water tanks; (4) Cape Asbestos Company, pipe covering.

Value of Stores and Standardisation.

As required by the standing orders, the Highways Committee reported that they had forwarded to the Finance Committee an estimate of the value of stock of stores in connection with the tramways department as at March 31, 1907. It was proposed to substitute an estimate for £100,000 for one of £50,000 previously given.

The Finance Committee said that the largeness of the stock was due, to a great extent, to the fact that open tenders were invited for the cars, and that each manufacturer supplied different equipments covered by patents, the number of items which had to be kept in stock being thereby greatly increased. There were at present four distinct types each of trucks, motors, and controllers, and seven types of car bodies in use on the Council's electric tramways, and the opening of trolley and surface-contact lines would still further multiply the number of spare parts required. The Finance Committee understood that, as far as possible, all new cars were being built to standard, and they had suggested to the Highways Committee that it might be possible to standardise the equipments to a greater extent than at present obtained.

King's Cross Accident.

Reference was made by the Highways Committee to the accident resulting in the injury of several persons which occurred on the Council's tramways on Christmas day last, owing to an electric car getting out of control down hill, and crashing into a car which was standing at the King's Cross terminus. Lieut.-Col. Yorke, of the Board of Trade, had now reported on the accident, and had stated that the motorman did not descend Pentonville Road with sufficient care, but permitted the car to coast down the hill until it was within 100 yards of the terminus, and allowed the speed to become too great before he applied the magnetic brake. The Committee added that the motorman had been discharged from the Council's service.

Battersea Reconstruction.

The adjourned report proposing estimates for the reconstruction on the conduit system of the Queen's Road, Battersea, lines was adopted, and at a meeting on April 14, it was decided that the Works Committee should carry out the work at an estimated cost of £31,000.

Annual Estimates.

The Finance Committee submitted the estimates of capital expenditure for the year 1908-9. It appeared that the total estimate of the Highways Committee for tramway capital expenditure is £1,300,000. There will be a further capital expenditure in respect of improvements when carried out by the Improvements Committee on new tramway routes.

The total estimates were approved by the Council for the purposes of insertion in the Money Bill.

In a discussion which took place at the meeting of the Council on April 7,

Mr. W. Hayes Fisher (Chairman of the Finance Committee) referred among other things to the tramways, and said that it was advantageous to complete the process of reconstruction at the earliest possible moment. The estimates showed that the lines which were still being worked by horse traction were being maintained at a very heavy loss, partly due to the loss of traffic receipts which occurred while the lines were under reconstruction. It was satisfactory to find that the results of electrical working during last year were considerably better than the original estimates, and the estimated surplus for the year of £41,788 had grown to £66,547, which it was proposed to transfer wholly to the renewals reserve fund, together with the balance brought forward of £5,923, making a total addition to the fund of £72,470. For the new year the surplus was estimated to amount to £110,883, and after reserving £10,000 for contingencies, the Highways Committee suggested that the whole of the balance should be transferred to the renewals reserve fund, which it was estimated would amount at the end of the year to £316,808. The sum of £100,883 for the year was equal to about four-fifths of the penny per car mile which has been tentatively adopted as the standard to be aimed at. The surplus was the amount left after payment of working expenses of all kinds, and paying interest and sinking fund charges on the capital of the undertaking. For 1908-9 the sum to be provided for repayment of capital was £254,968, and out of the total capital raised for tramway purposes up to March 31 last (nearly £8,500,000), £1,082,000 had been repaid, £819,000 out of tramway revenue and £263,000 out of the proceeds of sales of property, houses, etc., no longer required. While this was satisfactory, the financial position of the undertaking was not such that the Council could afford to entertain demands for lower fares and for expensive extensions in many directions.

Purchase of Highgate Hill Tramways.

At the meeting of the Council on April 7, the Highways Committee submitted a report on the proposed purchase of the Highgate Hill cable tramways. From this it appeared that as a result of further negotiations the tramway company were prepared to sell the undertaking to the Council for £13,500. The company would withdraw their Bill for the electrification of the tramways now before Parliament. The agreement for the purchase would have to be confirmed by Parliament, and it was proposed that the County Council should promote a Bill next year for the purpose. The line, which is

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three-quarters of a mile long, will connect with the County Council's tramways at Highgate Archway. The Finance Committee stated that the total ultimate expenditure, including reconstruction on the conduit system of electric traction, would be about £53,200. This would include £10,700 for street widenings. After meeting debt charges and renewals fund, there would be a deficiency at first of £1,441 a year, which would gradually diminish. The induced traffic over other parts of the system would, however, be considerable.

Consideration of the report was adjourned, but approval to it was given at the meeting of April 14.

NEW CONTRACTS.

About 475 tons of track rails and fastenings will be necessary for the reconstruction of the Queen's Road, Battersea, tramways, and on the proposal of the Committee it was agreed that an existing contract with Walter Scott, Limited, should be extended so as to include this additional quantity. The expenditure would be about £3,632.

As the Brixton Road to Camberwell Green tramways are to be reconstructed on the overhead wire system, it will be necessary to fit fourteen of the Council's cars with overhead trolley equipments. The cost was estimated not to exceed £25 a car, and it was agreed that the work should be done by the staff of the tramways department.

The acceptance of a tender by F. W. Rowlands and Company for 20,000 brake-wearing shoes at £937 10s. was reported. The amount would be charged to revenue account.

FOREIGN RAILS QUESTION.

On December 8, 1903, the Council asked the Committee to ascertain and report the number of hours of labour per week worked by the men employed by foreign firms in making rails, the rates of wages per hour paid to such men, and whether they did any work on Sundays, and the amount of mining royalties paid by foreign firms. Soon after the passing of this resolution information was collected, but it was incomplete. The Committee now reported that they were advised that it was not possible without a further extensive inquiry to complete the information, and in the circumstances they recommended that no further action be taken in the matter. This was agreed to.

A TRAMWAYS GUIDE.

The Committee proposed that expenditure not exceeding £1,000 should be incurred in the preparation and issue of a guide to the Council's tramways, and that the printing of a first edition of 100,000 copies should be authorised, the sale price to be 2d. a copy. The book would contain an alphabetical list of places of interest in London, together with, in the case of those accessible by tramway, an indication of the route by which they might be reached, and a list of the tramway routes, with route diagrams and particulars of car services, fares, etc.; illustrations and advertisements would be included. The Finance Committee, commenting on the matter, estimated that even if the whole edition were sold there would be a net cost of £583.

After considerable discussion it was resolved to approve the publication of the guide, but to ask the Committee to report again as to the price.

HARROW ROAD TRAMWAYS.

A long report was presented by the Parliamentary Committee in reference to proposals for purchasing the part of the Harrow Road and Paddington tramways within the county of London, and also in regard to the bill now being promoted by the Metropolitan Electric Tramways Company for the extension of the line to Edgware Road. In accordance with the proposals of the Highways Committee on the matter, which had been decided upon after long negotiations, the Parliamentary Committee recommended that an agreement be made with the tramway company to proceed with their bill, subject to an agreement that the company would execute the street widenings and construct the tramways; the Council would purchase the tramways at the expiration of six months from the date of completion, paying the actual expenditure for construction and street widenings, and the company would enter into a further agreement under which it would have running powers over the extension to Edgware Road.

Consideration of this report was postponed, and, a week later, it was resolved by 55 votes to 51 to refer the matter back to the Committee on the ground that the Improvements Committee had not been consulted.

REPAIR DEPÔT EQUIPMENT.

At a meeting of the Council on April 14, the Highways Committee reported that they had considered eight tenders received for the supply and erection of shafting, brackets, pulleys, etc., required for the first portion of the central car repair depôt in Woolwich Road. The lowest tender, exclusive of pulleys, was that of the Forced Lubrication Company, Manchester, at £400 3s. 2d., and it was proposed that this should be accepted, together with a provisional sum of £100 for pulleys.

It was also recommended that a tender by H. W. Ward and Company at £103 14s. 9d., be accepted for the provision of accessories for a 7¾ in. capstan lathe at the car repair depôt.

The proposals were confirmed.

PERMANENT WAY RENEWALS.

It would be necessary, the Committee noted, during the current year to renew portions of the permanent way at junctions where traffic is heavy. The tramways in question had been in operation by electric traction since May, 1903, and January, 1904. Hadfield's Steel Foundry Company had offered to supply the special track work for renewals at £4,524 10s., and on the proposal of the Committee this offer was accepted.

HOLIDAYS FOR EMPLOYEES.

The Committee recommended that drivers and conductors of electric cars be allowed two days' holiday, with pay, for each year of service on electric cars, with a maximum of six days a year. If this arrangement was adopted, the cost involved in the current year would be about £2,600, and by 1911-12 it would be £6,500.

Some members of the Council considered that the Committee should go further in granting holidays, but after discussion the recommendation was adopted.

CHANGES IN FARES.

The subject of the double journey tickets at present issued at 3d. on the northern lines was reviewed by the Committee, who considered that 3d. was too low a fare for the long journeys possible, and that it ought to be 4d. This would be carried out by cancelling the return fare for the whole distance, and substituting graduated return stages. Pending, however, the electrification of the horse tramway routes the existing arrangements on the horse lines should be continued.

It was agreed that consideration of this matter be postponed.

HAMMERSMITH TO PUTNEY TRAMWAYS.

A long narrative was presented in regard to the construction of this line, and to the negotiations, which had now resulted favourably, with the Fulham Borough Council in regard to the use of the trolley wire system, and as to the arrangements for wood paving. Subject to the Council obtaining Parliamentary powers this session for the use of the trolley system, the work of construction would be commenced as soon as possible, and a through tramway route would then be afforded from Putney to Harlesden. The length of the line from Hammersmith to Putney was equal to about 4¼ miles of single track, and the total estimated cost was as under:

	£
Trackwork, etc., including special work, and £7,800 for rails ...	34,100
Overhead equipment...	5,650
Cable ducts	3,500
Cables and feeder pillars	3,000
Rolling stock	5,700
Sub-station plant and equipment	2,500
Total	£54,450

The Council adjourned till May 12.

ALLEGED BIAS OF JUSTICES DISCREDITED.

In the King's Bench Division of the High Court of Justice on April 6, cause was shown for setting aside two rules nisi which had been granted for a writ of prohibition to justices of Middlesex who are members of the Middlesex County Council, forbidding them to hear certain appeals by the Metropolitan Electric Tramways Company against rates imposed by Hendon Union. The averment of the company was to the effect that as Sir Ralph Littler and other justices were members of the County Council they were disqualified from hearing the appeals, as the tramways rated were owned by the County Council and leased to the tramway company. The Lord Chief Justice, in giving judgment, said that the highest at which the pecuniary interest could be put against the justices was that they were members of a body, which body, as trustees, not levying rates itself, might receive a sum of money differing slightly according to the amount of the rates on these tramways. It was suggested that there was a possibility that these gentlemen, as members of the County Council, were likely to be biassed. In his judgment that would be a great deal too far-fetched a view. It would not be right to suggest, on such materials, that there would in fact be any bias, or that any reasonable man would think so, and that the sources of justice would be tainted. Mr. Justice Ridley and Mr. Justice Darling were of the same opinion, and the rules were discharged.

LIABILITY FOR SNOW REMOVAL

An interesting point was decided by Judge Howland Roberts at Brentford County Court on March 27. An action was brought by Acton District Council against the London United Tramways Company to recover £25, the cost of removing snow thrown by the tramway company on the margins of the road by the snow plough used to clear their tracks. Alternatively the Council claimed penalties for a nuisance. His Honour held that there was an obstruction by the company piling snow on the sides of the roadway. He considered the £25 expended in removing the snow represented the amount of damages, and he found for the Acton Council for this sum, with costs on the higher scale.

Middlesex Tramways.—The last section of the Waltham Cross and Enfield light railway, which has been constructed by the Middlesex and Hertfordshire County Councils, was opened for traffic on April 17. The Metropolitan Electric Tramways Company, the lessees of the whole system, are now running cars between Waltham Cross and Finsbury Park. On the same day the tramway service from Harrow Road to Stonebridge was extended to Wembley.

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FINANCIAL COMMENT.

The financial outlook shows little sign of any change for the better as far as the prospects of the share market are concerned, nor is it possible that any durable improvement should set in until the pressure to create new issues of capital be reduced. It will have been noticed that a large proportion of the recent issues have been for foreign accounts. A good deal of this capital, as well as some ostensibly for home use, was no doubt actually expended during the late period of trade activity, and what we are now witnessing is, to a great extent, a transfer of credits from the trader to the public which will not effect any increase in the returns of our export trade. Business of this kind tends to inflation and is seldom healthy. The traders who have found a profit in the chain of transactions as a whole are lucky. Fundamentally, it is the suspicion of inflation and often the existence thereof that is keeping low the prices of all stocks and shares.

UNDERGROUND ELECTRIC RAILWAYS COMPANY OF LONDON.

The proposal made to the profit-sharing secured note-holders of this company has been explained in our notices of financial reports during the month. The note-holders are invited to consent to the creation of £1,000,000 prior lien bonds of 5 per cent., and to taking 40 per cent. of their holding in 4½ per cent. bonds to bearer and 70 per cent. in income bonds of 6 per cent. As the present earning capacity of the railways is insufficient to insure payment of interest on the 4½ per cent. bonds, Messrs. Speyer Brothers of London, Messrs. Speyer & Co. of New York, and Mr. Speyer-Ellissen of Frankfort-on-Maine, have come forward with admirable courage and undertaken to furnish sufficient funds to meet the interest requirement of this stock for a period long enough, it is hoped, to enable the traffic of the railways to grow to a point at which this interest may be paid out of the profits of the company. The wording of the statement deserves attention:

> " . . . undertaken to purchase on or before each January 1 and July 1, commencing with January 1, 1908, such an amount of 4½ per cent. bonds and income bonds at the price of £300, and accrued interest on the 4½ per cent. bonds, for £200 (nominal) of 4½ per cent. bonds, and £300 (nominal) of income bonds (taken together) as will by the proceeds make good any deficiency in the full interest for the preceding half-year on the 4½ per cent. bonds which the revenues of the company to the close of such half-year remaining after making or providing for all payments on revenue account (except interest on the income bonds) but before providing for reserve are insufficient to meet."

The phrase "and accrued interest on the 4½ per cent. bonds" has been a stumbling block to many, but the meaning obviously is that the bonds are acquired on the terms named *ex dividend*. At the present low level of prices in the stock markets the 4½ per cent. bonds would probably be quoted about 60, at which price the yield would be 7½ per cent. It will be seen that the above arrangement involves a larger valuation for the income bonds, £500 (nominal) in all being given for £300 sterling. According to the present market quotation for the profit-sharing notes, about 40, the income bonds would be worth no more than 23, at which price the yield would be 7½ per cent., and it will be seen that the above arrangement involves an equal price being given for the income bonds, since £500 (nominal) in all is received for £300 sterling. According to the market quotation of the profit-sharing notes, which hovers about 40, the income bonds would be worth no more than 23 if 60 be taken as the value of the 4½ per cent. bonds.

Thus:

£40 of 4½ per cent. bonds at 60	=	£24.
£70 of 6 per cent. income bonds at 23	=	£16.
		£40.

Messrs. Speyers are therefore behaving very handsomely.

In all probability as soon as the arrangement is completed it will be found that the market value of the 4½ per cent. bonds and the income bonds taken together in the proportions defined will be more than the present market value of the equivalent profit-sharing notes. It has almost invariably followed when a large stock of any kind has been divided into two denominations having different degrees of security, that the combined market value of the latter is the higher of the two. The reason is that the diverse demands of the public as to quality in security of investments or speculations is more closely supplied, and where public demand is supplied with greater detail it is not surprising if a higher price can be maintained.

A subsidiary feature of the proposal which has not received as much attention as it deserves is the phrase:

> "The rate of interest will be such as to yield a clear 4½ per cent. per annum after payment of British income tax."

A like phrase occurs in connection with the 6 per cent. income bonds. This provision was, no doubt, introduced to gratify holders living in the United States of America. It makes the paid charges of the company a variable quantity, a contract which probably could not be enforced in our own courts.

CALCUTTA TRAMWAYS COMPANY.

The report of this company for the year ending December 31, 1907, must have been received by the shareholders with mingled feelings, since although there is nothing to indicate that the future prospects of the company are impaired in consequence of anything that has happened during the year, the dividend is at the rate of 5 per cent. per annum, instead of 9 per cent., the rate declared at the same date the year before. The number of passengers carried was 27·4 millions, as compared to 26·1, an increase of 5 per cent. The number of cars in stock is given as 225 motor and an equal number of trailers, the cars being apparently run for the most part in pairs. Thus instead of car miles the statistical table gives train miles, which were 4,338,562 last year, as compared with 4,293,721 in the previous year, an advance of 1 per cent., so that the trains were rather better filled. Apart from that the figures do not show a very rapid development of traffic since the "miles of street tramways" are given as 27 as compared with 23, and the effect of the opening of the four extra miles at dates mentioned elsewhere must be taken as equivalent to at least one new mile of route open during the whole period. The report is accompanied by a map which shows, besides the lines open at the beginning of 1907 and those opened during the year, some six more route miles as complete but not yet in operation, and further short lengths in respect to the building of which negotiations are pending with the authorities.

The greater part of the six miles referred to are seen to be on the other side of the river with no connection with the main system; it will therefore be of less assistance in increasing the average density of traffic than would otherwise be the case. This part is expected to be opened in course of the present month. The tramways will then consist of 33 route miles, and the issued capital including debentures being £1,248,300, the cost will have been nearly £38,000 per mile—a high figure. The capital account shows a credit balance of £41,438, and it is to be hoped that this will suffice to cover the construction and equipment carried out since the date of the accounts and that yet to be completed. The depreciation fund stands at £48,080, and there are "investments" to the amount of £53,756 in the balance sheet, the nature of which is not stated.

Turning to the revenue account, the net profit has been affected by several causes. £3,500 arrears of track rent were debited during the year, and there were unusually heavy charges for maintenance owing to changes incident to new construction and to preparations for work on a larger scale. Then the capital spent upon the now completed, but as yet unopened, six miles of route diluted the profits to be distributed, while adding nothing to their amount; on the other hand the depreciation fund receives no addition on this occasion. The charges for maintenance and depreciation in the past appear to have been on a sufficiently liberal scale, and in the future, if the same standard is adhered to, an additional £12,000 per annum may be fairly counted upon as available for distribution among the ordinary shareholders, without discounting the possibilities of future expansions of traffic.

The distribution being at the rate of 6 per cent. for last year, ordinary shareholders might reasonably expect 7¾ per cent. as an average in the future; the danger for them lies in further issues of capital for constructing relatively unremunerative extensions. The present density of traffic—about a million passengers per route mile—is not high considering the close population of the land, and to bring about an increase it would be better to try a reduction of fares. The present average of 1·46d. per passenger is enormous when the ordinary rate of native wages is remembered.

THE GATESHEAD AND DISTRICT TRAMWAYS.

The ordinary shareholders of this company receive 7 per cent. for the year 1907 as compared with 6 per cent. for 1906, and 3 per cent. for some years before that. The statistics and information given in the report and accounts are insufficient to enable an opinion to be formed as to the adequacy of the provisions made against the depreciation of the property. The tramway was opened in May, 1901. Capital expenditure to date is £311,977. £11,892 has been accumulated against depreciation and accident, etc., and £4,835 of mortgage has been repaid. Possibly further information might establish the fact that the provision for depreciation is sufficient, but it is doubtful if the prospects of the company are improved by increasing the rate of distribution from 6 per cent. to 7 per cent. The report alludes to the serious depression in the shipbuilding industry on the north-east coast, as an inimical factor, in spite of which the earnings had been increased. The depression did not, however, take place until late in the year during which the profits were earned, and the full effect of loss of business and employment is seldom felt until a depression in trade has been for some time in existence. Shareholders will probably be well advised in expecting the average rate of dividends in the future to be lower.

THE OLDHAM, ASHTON, AND HYDE ELECTRIC TRAMWAY.

This company is in many respects comparable to the foregoing. The capital expenditure is £155,303, the provision for depreciation and reserve £12,500. This year a new account has been inaugurated, referred to as a "Provision for renewals account," and £1,716 was placed to the credit of this account before the balance was struck. The amount appropriated to the depreciation and reserve account, however, has at the same time been reduced from £2,000 to £1,000. Another innovation is the opening of a cumulative sinking fund for the redemption of the outstanding debentures of the company, the present amount of which is £40,000, redeemable on January 1, 1921.

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TRAMWAY AND OMNIBUS SHARE LIST.

Specially Compiled for "The Tramway and Railway World."

Amount Ranking for Dividend.	Shares.	Name.	Div'd. Prev. Half-year.	Di'vd. Last Half-year.	Quotations, April 30.	Movements During April. Rise.	Movements During April. Fall.	Latest Business Done. Price.	Latest Business Done. Date.	Yield on Buying Price. £ s. d.	Dividend Due.*	Quotations, 1907. Highest	Quotations, 1907. Lowest.
260,007	5	Anglo-Argentine Tramways 6% Cum. 1st Pref.	10%	3/-	6⅛—6⅜	+ ⅛	...	6 5/16	Apr. 29	4 14 3	*Apr.*, Oct.	6½	5 31/32
320,000	5	Do. do. 10% Non-Cum. 2nd Pref.	5½%	5/-	7⅞—8⅛	...	— ⅛	8	Apr. 29	6 4 0	June, *Dec.*	8	7½
135,000	1	Associated Omnibus Ord.	7½d.	for '06	1/16—3/16	...	...	...	...	...	...	...	...
75,606	1	Bath Electric Tramways Pref. Ord.	...	1/-	⅜—⅝	...	— ⅛	13/-	Mar. 3	...	*Apr.*, Oct.	1	¾
75,000	1	Do. do. 5% Cum. Pref. ..	5%	5%	11/16—13/16	...	— ⅛	16/3	Mar. 7	6 3 3	*Jan.* & July	1	13/16
15,000	10	Blackpool and Fleetwood Tramways	4/-	9/-	12—12¼	...	— ⅛	12⅜	Mar. 25	5 4 0	22 Aug.	...	...
100,000	16/-	Blackpool, St. Anne's, and Lytham Ord. ...	...	...	—⅛	...	...	...	...	...	...	...	...
50,000	18/-	Do. do. 5% Cum. Pref.	...	...	⅛—¼	...	...	...	...	...	...	...	...
60,000	10	Bombay Elec. Supply & Trys. Co. 6% Cum. Pref.	4/8·377	5/2·176	10—10½	+ ½	...	10 3/16	Apr. 22	5 14 3	Feb., Aug.	8⅜	7⅜
75,000	5	Brisbane Elec. Tramways Investment Co. Ord.	2/-	4/-	3⅝—3⅞	...	— ¼	80/-	Apr. 24	5 3 3	*May.*	3 7/16	1 11/16
75,000	5	Do. do. do. 5% Cum. Pref.	5%	2/6	4⅜—4⅞	...	— ⅛	96/3	Apr. 29	5 1 3	*May*, Nov.	5 1/16	4 9/16
50,000	10	Bristol Tramways and Carriage Co.	8½	9½	10—10½	...	— 1	13	Feb. 20	8 11 6	*Feb.*, Aug.	15¼	14
50,000	10	Do. do. do. 4% Cum. Pref.	4	4	8—8½	...	— ¼	9	Feb. 20	4 14 3	...	...	...
400,000£	Stk.	British Columbia Electric Railway Def. Ord. ...	8%	for '07	128—131	...	— 2	130¼	Apr. 29	6 2 3	May, Nov.	135	122½
300,000£	Stk	Do. do. Pref. Ord.	6%	for '07	111—115	+ 3	...	112	Apr. 25	5 7 3	May, Nov.	116½	105
300,000£	Stk	Do. do. 5% Cum. Perp. Pref.	5%	for '07	107—111	+ 2	...	109½	Apr. 27	4 12 9	May, Nov.	110¾	101
133,301	10	British Electric Traction Ord.	6/-	for '06	1¼—1¾	+ ⅛	...	28/9	Apr. 30	...	Apr., *Oct.*	4 17/32	1¼
161,437	10	Do. do. 6% Cum. Pref. ...	6/-	...	4—4½	...	...	81/3	Apr. 25	...	Feb., *Aug.*	8½	4½
100,000	5	Buenos Ayres and Belgrano Electric Trys. Ord.	3/-	for '07	4⅝—4⅞	...	...	93/9	Mar. 10	3 1 6	*Apr.*, Oct.	4 9/16	2 31/32
40,000	5	Do. do. "A" 6% Cum. Pref.	6%	3/-	4⅝—5⅛	...	...	98/9	Apr. 29	5 17 3	*Apr.*, Oct.	5½	4¾
27,500	5	Do do. "B" do.	6%	3/-	4⅝—5⅛	...	...	5	Feb. 10	5 17 3	*Apr.*, Oct.	5⅜	4¾
113,436	5	Buenos Ayres Grand National Tramways Ord....	...	...	2⅛—2⅜	...	— ¼	47/6	Apr. 8	...	*Jan.*	3⅜	2
90,000	5	Do. do. do. 5% Cum. Pref.	3/-	2/6	3¾—4¼	...	...	78/9	Apr. 13	5 17 9	...	4¾	3¾
137,610	5	Calcutta Tramways Ord.	3/6	2/6	6—7	...	— ½	6 7/16	Apr. 29	4 5 9	*Apr.*, Oct.	8 15/16	6⅜
42,128	5	Do. 5% Cum. Pref.	5%	2/6	5—5⅜	...	...	5 3/16	Mar. 14	4 13 0	Jan., July	5⅜	5 1/16
491,222	1	Cape Electric Tramways	6d.	for '05	3/16—7/16	...	...	5/3	Apr. 7	...	Feb., *Nov.*	9/16	⅛
15,000	10	Carthagena and Herrerias Steam Tramways ...	7%	6/-	3½—4½	...	— ½	91/3	Mar. 18	17 15 9	*June*	11¼	6 31/32
40,000	5	City of Birmingham Tramways 5% Cum. Pref.	10%	2/6	4¼—4¾	...	— ⅛	5 31/32	Mar. 4	5 5 3	*Apr.*, Oct.	5½	4 9/16
248,000	5	City of Buenos Ayres Tramways (1904) ...	5%	1/3	5¼—5½	+ 1/16	...	5 13/32	Apr. 29	4 11 0	*Apr.*, Oct.	5½	4 29/32
60,000	1	City of Carlisle Electric Tramways	1¼%	for '06	2/3—2/9	...	...	...	...	...	*Feb.*	...	...
5,000	10	Clontarf and Hill of Howth Tramways ...	...	1%	5⅛—6⅛	...	— ⅛	6⅛	Apr. 1	1 12 0	...	...	...
11,500	10	Cork Electric Tramways and Lighting Co. ...	10/-	ann.	9¼—9¾	...	...	...	...	3 3 3	*Mar.*	9¾	8¾
12,327	10	Do. do. do. 5% Cum Pref.	5/-	5/-	9¾—10¼	...	...	10	Feb. 26	4 17 9	Jan. 1. Dec. 30	...	..
3,000	10	Dublin and Lucan Elec. Railway 5% Cum. Pref	5/-	5/-	5¾—6¼	...	...	6	Apr. 24	8 0 0	Sep. 15. Aug. 29	...	...
1,900	10	Do. do. do. Ord. ...	...	...	—3½	...	...	...	...	...	...	...	...
60,000	10	Dublin United Tramways Co. (1896), Ltd., Ord.	6/-	7/-	12¼—13¼	...	...	12 11/16	Apr. 29	4 16 6	Feb, Aug.	15	12⅞
59,987	10	Do. do. do. 6% Cum. Pref.	6/-	6/-	12½—13½	...	...	12⅞	Apr. 30	4 9 0	*Feb.*, July	14 13/16	12⅞
40,000	5	Hastings and District Elec. Trys. 6% Cum. Pref.	...	4/-	4—4¼	...	...	80/-	Apr. 20	7 1 3	*Mar.*, Sept.	4⅛	4⅛
20,000	10	Imperial Tramways Ord.	8	10	10½—11½	...	— ¼	11¼	Feb. 20	8 0 0	...	...	...
20,000	10	Do. 6% Cum. Pref.	6	6	9¾—10¼	...	...	10⅜	Feb. 20	5 17 3	...	...	...
30,000	5	Isle of Thanet Elec. Try. & Ltg. Co. 5% Cum. Pref.	1/3	for '06	⅞—1⅜	...	...	20/-	Feb. 17	...	*Mar.*, Sept.	2½	1
250,000	1	Kalgoorlie Electric Tramways	...	...	1/32—3/32	...	— 1/32	1/3	Apr. 30	...	*May*	3/32	1/16
28,723	10	Lanarkshire Tramways	5/6	6/-	9¾—10¼	...	...	9⅞	Apr. 23	5 12 3	Feb, Aug.	10½	9¾
594,188	1	Lisbon Electric Tramways Ord.	5	1/-	1—1¼	...	— ⅛	20/-	Feb. 15	4 4 3	*July.*	1 7/16	⅞
425,553	1	Do. do. 6% Cum. Pref ...	6	7½d.	1—1¼	...	— ⅛	...	...	5 2 3	*July.*	1 5/16	⅞
773,592£	Stk.	London General Omnibus Ord.	5%	for '07	27—33	...	...	29	Apr. 30	...	Mar., Sept.	79	36
25,000	10	Do. do. 5% Cum. Pref. ...	5%	5/-	4—5	...	...	91/3	Mar. 20	...	Jan., July.	9½	4½
74,000	6	London Road Car	2/6	for '06	¾—1¼	...	— ¼	20/-	Apr. 29	...	Feb., Aug.	4	2⅛
8,200	10	Do. 5% Cum. Pref.	5/7½	5/-	5—7	...	...	6	Feb. 3	7 2 9	Feb., Aug	...	...
31,000	4	London Street Tramways	2/-	2/6	5/16—7/16	...	— ⅛	...	...	..	*Mar.*	11/16	⅜
125,000	10	London United Trys. (1901), Ltd., 5% Cum. Pref.	2	5/-	6¾—7¾	+ ¼	...	7¼	Apr. 20	6 13 6	*Jan.*, July.	9½	7⅜
22,900	5	Manx Electric Railway 5½% Cum. Pref.... ...	5½	2/9	4½—5	...	...	...	...	5 10 0	June, Dec.	5⅛	4⅝
314,016	1	Metropolitan Electric Tramways Def.	...	...	1/16—3/16	...	...	1/6	Apr. 30	Nil	...	3/16	1/16
500,000	1	Do. do. do. 5% Cum. Pref.	6d.	6d.	11/16—13/16	...	— 1/16	15/-	Apr. 30	6 3 3	*Feb.*, Aug.	1	¾
$6,000,000	$100	Mexico Tramways Common Stock	2%	$1	83—85	+ 7½	...	85¼	Apr. 28	4 17 0	Feb. 1. May 1 Aug. 1, Nov. 1	...	...
50,000	5	New General Traction 6% Cum. Pref.	...	...	½—1	...	...	...	...	...	Jan., *July.*	1¾	¾
110,923	4½	North Metropolitan Tramways	1/-	...	⅛—⅜	...	...	5/-	Apr. 6	...	...	...	...
5,000	10	Oldham, Ashton, and Hyde Elec. Tramways Ord.	7/-	5/-	8⅜—8⅝	+ ¼	...	9⅜	Mar. 23	6 19 3	...	...	...
5,000	10	Do. do. do. 5% Cum. Pref.	5%	5%	8—8¼	— ⅛	...	...	...	6 1 3	...		..
100,000	1	Perth (W.A.) Electric Tramways Ord.	5%	1/-	5/16—7/16	...	...	...	...	7 5 6	*Mar.*	11/16	9/16
245,000	1	Potteries Electric Traction Ord.	...	9⅜d.	¼—⅓	...	...	...	...	9 3 0	*Mar.*	¾	¼
245,000	1	Do. do. 5% Cum. Pref. ...	5	6d.	½—¾	+ ⅛	...	11/-	Apr. 10	8 0 0	*Feb.*, Aug.	13/16	½
24,912	10	Provincial Tramways Ord.	3/-	5/-	4¾—5¼	+ ¼	...	4⅞	Jan. 23	7 12 6	*Dec.*	5⅜	4
10,000	10	Do. do. 6% Cum. Pref.	6/-	6/-	9½—10½	...	...	10 1/16	Feb. 11	5 14 3	June, *Dec.*	11½	10¼
30,000	5	Rangoon Elec. Trys. & Supply Co. 6% Cum. Pref.	...	3/-	5¼—5¾	+ ¼	...	5 7/16	Apr. 6	5 4 6	June, Dec.	5¾	5
250,000	$100	Rio de Janerio Tramways Light and Power Co.	...	...	34—35	...	— 3	37½	Feb. 5	...	...	...	
85,000	$100	Sao Paulo Tramway, Light, and Power Co. ...	$2¼	$2¼	129—134	+ 8½	...	131	Apr. 23	6 6 0	*Apr.*, Oct.	145	101
6,343	10	Snowdon Mountain Tramroad Ord.	...	...	5—8	...	...	...	...	...	...	...	...
169,570	1	S. Metrop'n Elec. Trys. & Ltg. Co. 6% Cum. Pref.	6½d.	7½d.	¾—1	...	— 1/16	19/-	Mar. 3	6 8 0	Feb., Aug.	1 1/32	⅞
3,900	5	Southport Tramways	...	...	3—3⅛	...	...	...	...	...	...	...	...
30,000	5	Star Omnibus 5½% Cum. Pref.	2/9	for '05	...	...	— ¾	...	...	...	Jan., July.	1½	¾
40,000	5	Yorkshire (West Riding) Elec. Trys. Ord. ...	...	...	1—1½	...	...	...	...	...	*Mar.*	1½	¾
46,261	5	Do. do. do. 6% Cum. Pref.	...	...	3⅛—3⅜	+ ⅛	...	72/6	Jan. 22	...	*Mar.*	3¾	3⅛

ELECTRIC RAILWAY SHARES.

1,853,610£	Stk.	Central London Ord. Stock	3	3	74—77	+ 6	...	76	Apr. 30	3 17 0	*Feb.*, Aug.	82¾	54½
1,480,000£	Stk.	City and South London Cons. Ord. Stock ...	2½	1¾	39—41	+ 2	...	39¾	Apr. 30	5 3 9	*Feb.*, Aug.	50½	39
78,000	10	Great Northern and City Pref. Ord. 4% ...	11¼d.	...	¾—1¼	...	— ¼	20/-	Apr. 20	...	*Feb.*, Aug.	3¾	1⅛
159,000	10	G.N., Piccadilly, and Brompton Ord.	4/-	4/-	6—7	+ ½	...	6½	Apr. 23	5 14 6	*Feb.*, Aug.	8	4
50,000	10	Liverpool Overhead Ord.	...	6d.	1⅜—1½	...	...	28/9	Apr. 10	1 13 6	*Feb.*, Aug.	2	1¼
1,412,262£	Stk.	Mersey Cons. Ord. Stock	...	...	2—4	...	...	...	...	Nil	*Feb.*, Aug.	7	2
5,732,062£	Stk.	Metropolitan Cons.	½	½	42—43	+ 2	...	42¾	Apr. 30	1 3 6	*Feb.*, Aug.	60¼	31½
3,235,000£	Stk.	Metropolitan District Ord.	...	...	11½—12½	+ 1	...	11¾	Apr. 30	Nil	*Feb.*, Aug.	19¼	7¼
2,499,200£	...	Underground Electric Railways Co. of London, Ltd., 5% Profit-sharing Secured Notes.	5%	ann.	36—40	...	— 4	38	Apr. 23	12 10 0	*June*, Dec.	89	34
1,100,000	...	Do. do. Deposit Receipts ...	...	...	36—40	...	— 4	39¼	Apr. 24	...	...	...	...

* Date of final payment is given in italics.

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The accumulation of a sum sufficient to pay off the whole amount at that date would require an annual charge of £2,100, even if the rate of interest were taken at 4 per cent. Only £500 has been appropriated on this occasion. Still it is well that a beginning has been made, and that the dividend on the ordinary shares has not been advanced beyond the rate paid in recent years, that is to say 6 per cent.

THE CITY OF BIRMINGHAM TRAMWAYS.

This company's sphere of operation is much reduced, and 18·13 route miles were worked as compared with 33·85 the year before. The receipts per passenger diminished from 1·24d. to ·98d., and the expenses from ·73d. to ·64d., the working ratio increasing from 59 per cent. to 64 per cent. The revenue account baldly states £82,539 as the cost of general working and renewals without further detail. The return on the ordinary shares comprises a dividend of 5 per cent. per annum, and a bonus at the same rate, making 10 per cent. in all, but the dissolution of the company is in contemplation, and although the various negotiations which have yet to be carried on with local authorities make it inadvisable to put the company into liquidation at present, the chief interest for all shareholders lies in the balance sheet rather than in the revenue account. The capital outlay to date is given as £534,028; against this may be set the reserve account of £431,768, together with £27,353 the appropriation for this year, making £459,121. This leaves £74,907. Stores, the debenture redemption fund, investments and cash, together with sundry debtors and debit balances, amount to £552,681. Thus the total value of the assets may be taken at £627,588, on the assumption that the reserve is sufficient to cover losses on investments as well as depreciation of plant and construction. Deducting from this the amount of debentures outstanding, £300,000, and sundry creditors, credit balances and other liabilities amounting to £37,086, we have £290,506 to cover a total issue of shares of several denominations to the amount of £284,188. So far so good, but the result of this examination is not worth much, because the figures upon which it is based are not supported by sufficient facts to make them convincing or even persuasive.

It is much the same with the other companies noticed. The statement of expenses is undetailed, the statement of statistics is perfunctory, and the statement of assets is practically absent; in its place we have a barren exhibition of the capital sunk, and possibly lost for all that can be learnt from the accounts to the contrary.

The directors of companies owning and working tramways would be well advised to take their shareholders and the public as well, more into their confidence in all matters of this kind.

The present attitude of investors towards tramway enterprise is not so encouraging, that those embarked in the business can afford to disregard the legitimate demands of prudent investors for facts.

Probably in these cases a policy of greater openness would disclose an actual condition of things better than that imputed to the companies, and it would in any case stimulate interest in the financial position and prospects of the tramways, and so benefit an industry which is most in danger from the apathy and indifference of the investing public.

RIO TRAMWAYS, LIGHT AND POWER COMPANY.

A very interesting statement has been issued by the Rio de Janeiro Tramway, Light and Power Company, regarding the present position of the undertaking. It will be remembered that in order to provide for further capital requirements the company authorised an issue of £3,500,000 second mortgage debentures. A portion of this has already been raised on the Continent, with the result that Mr. Quellenec and Mr. Javal, of Paris, and Mr. Verstraeten, of Brussels, have been elected directors of the undertaking. The wide experience of these gentlemen, both technical and practical, and the financial group which they represent, should do much to strengthen the position of the company.

With regard to the progress of the undertaking it is stated, in respect of the light and power business, that all the construction work in Brazil, which has been in hand for several years, is nearing completion, and that the electric light and power circuits are sufficiently advanced to enable the company to contract for business throughout the City of Rio, in which the great demand for power and light exists. Of the tramway system controlled by the company, comprising 130 miles, 37 miles are worked by electric traction and 93 miles by animal traction. The electrical equipment of the latter is now being undertaken, and it is estimated that 30 miles will be converted to electric traction and in operation by the end of this year.

After deduction of federal and municipal taxes the combined earnings of all properties controlled by the company showed remarkable growth, the gross last year having been £1,291,700, against £1,097,000 for 1906, and the net earnings £437,210, against £300,545. For the first three months of the present year gross earnings were as much as £336,593, as compared with £291,910 in 1907, and the net earnings £123,480, as compared with £89,027. The board anticipate that, as a result from the works already completed, from now onward the earnings will show a steady increase, and that they will be greatly augmented when the contemplated works are completed.

ELECTRIC TRAMWAY LEGISLATION.

SECOND READINGS.—In the House of Lords.—April 7; Metropolitan Electric Tramways.

In the House of Commons.—April 6; London County Council (Tramways and Improvements) April 29: London United Tramways.

THIRD READINGS.—In the House of Commons.—April 27: Leeds Corporation.

AYR CORPORATION.—A Commission sitting in Glasgow under the Scotch Private Legislation Procedure Act passed this Provisional Order application on May 1. There was no opposition. The Order authorises the Corporation to construct two additional tramway lines.

BLACKBURN CORPORATION.—This bill has been passed by a Committee of the House of Commons, but the part of it proposing to give the Corporation power to run motor omnibuses was rejected. It was opposed by the railway companies, and the case for it was not supported by estimates of revenue and expenditure. The tramway extension proposals were authorised.

EDINBURGH CORPORATION (TRAMWAYS, ETC.) ORDER CONFIRMATION.—This is a bill just introduced in the House of Commons to confirm a Provisional Order granted by the Secretary for Scotland to enable Edinburgh Corporation, among other things, to construct a tramway three-quarters of a mile in length, as an extension of their Gorgie Road line to a new cattle market in Slateford Road.

LANARKSHIRE TRAMWAYS.—This application for an Order under the Scotch Private Legislation Procedure Act came before a Parliamentary Commission sitting in Glasgow on May 1. The objects of the proposal are to extend the time by three years for the completion of certain authorised tramways, and to enable the company to run omnibuses and to raise additional share capital to the extent of £153,000, with £51,000 of additional borrowing powers. It was mentioned that the length of lines already completed was 15½ miles, and 12 miles more had yet to be constructed. There was no opposition, and the Order was passed.

NOTTINGHAMSHIRE AND DERBYSHIRE TRAMWAYS.—This is a new bill of which notice was only given on April 7, and it remains to be seen whether the Parliamentary standing orders will be suspended to allow it to proceed this year. It is largely the outcome of an agreement recently arrived at between the promoters (the Nottinghamshire and Derbyshire Tramways Company) and Nottingham Town Council. The bill proposes to extend the time for the purchase of lands and the completion of tramways authorised in 1903, to transfer to Nottingham Corporation the powers to construct certain of the authorised tramways, to confirm agreements for running powers, to alter the capital of the company, to enable the Corporation to make additional tramways, and to lease any part of their tramways to the company, etc.

WIDNES CORPORATION.—This bill has been passed by a House of Commons Committee. It authorises the Town Council to run motor omnibuses for the benefit of a somewhat scattered district, which does not have sufficient population to warrant the construction of tramways.

LIGHT RAILWAY ORDERS.

The Light Railway Commissioners have submitted to the Board of Trade for confirmation the North Shropshire Light Railway Order, 1908, authorising the re-construction and working as a light railway of certain parts of the railways and works of the Shropshire Railways Company in Shropshire and Montgomeryshire; also the Aldershot and Farnborough Light Railway Order, 1908, authorising the construction of light railways in the urban districts of Aldershot and of Farnborough, in the county of Southampton, and in the rural district of Farnham, in the county of Surrey.

The Commissioners have issued their draft Tickhill Light Railway (Amendment and Transfer) Order, extending the periods limited by the Tickhill Light Railway Order, 1901, as amended by the Tickhill Light Railway (Extension of Time) Order, 1904, for the compulsory purchase of lands for and for the completion of the railways and works thereby authorised, and authorising the transfer to the Great Northern Railway Company of the powers conferred by those Orders on the Tickhill Light Railway Company, and giving powers for the construction of additional lines and for other purposes.

The Commissioners have fixed local inquiries as follows: Blackburn, Whalley, and Padiham Light Railways (Revival and Extension of Time) Order on Friday, May 8, at the Town Hall, Blackburn, at 9-45 a.m.; Southend and Colchester Light Railways (Extension, Time, New Works, etc.) Order on Wednesday, May 13, at the Public Hall, Burnham-on-Crouch, at 11 a.m.

The Board of Trade have confirmed the London United Tramways Light Railways (Extension of Time) Order, 1908, amending the London United Tramways (Light Railway Extensions) Order, 1904. The Board have decided to require the promoters of the Barton and Immingham Light Railway Order to provide a bridge instead of a level crossing over a road at Barrow-on-Humber.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track). Mls.	Chs.	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Sinking Fund and Loans Repaid.	Depreciation, Renewal, and Reserve Funds.	Income. Traffic.	Other.	Total.
Aberdeen ...	May 31, 1907	Dec., 1899	E.	27	60	350,000	317,140	32,860	345,025	12,435	299,970	17,169	40,155	65,853	834	66,687
Ayr ...	May 15, 1907	Sept., 1901	,,	9	52	105,000	70,000	35,000	79,934	8,283	62,752	4,820	14,954	14,672	541	15,213
Birmingham ...	Mar. 31, 1907	Jan., 1904	,,	...		1,079,687	743,037	336,650	850,916	...	732,016	11,021	25,932	132,662	3,762	136,424
Blackburn ...	Mar. 25, 1907	Mar., 1899	,,	23	64	400,337	328,087	72,250	330,563	13,469	236,042	81,647	...	52,811	2,141	54,952
Blackpool ...	Mar. 31, 1907	June, 1899	,,	17	30	424,490	281,390	143,100	281,390	16,195	281,390	54,624	13,236	50,554	952	51,506
				* 3	69											
Bolton ...	Mar. 31, 1907	Dec., 1899	,,	42	42	632,760	528,027	104,733	471,760	11,093	377,482	71,801	48,622	110,935	359	111,294
Bradford ...	Mar. 31, 1907	July, 1898	,,	87	67	1,192,626	902,878	289,748	903,368	9,321	756,992	200,046	38,024	227,495	4,612	232,107
				* 9	6											
Brighton ...	Mar. 31, 1907	Nov., 1901	,,	17	15	279,070	274,070	5,000	274,905	15,994	257,186	20,885	3,165	48,898	1,755	50,653
Burnley ...	Mar. 31, 1907	Dec., 1901	,,	14	20	278,892	252,896	25,996	185,325	13,005	175,331	23,012	20,793	62,076	728	62,804
				* 5	32											
Burton-on-Trent	Mar. 31, 1907	Aug., 1903	,,	9	70	100,073	88,336	11,737	92,971	9,415	83,746	...	...	15,102	430	15,532
Bury ...	Mar. 31, 1907	June, 1903	,,	17	50	407,800	225,525	182,275	242,466	13,757	223,500	8,246	5,904	50,518	131	50,649
				* 9	21											
Chester ...	Mar. 25, 1907	April, 1903	,,	6	35	92,991	73,991	19,000	77,662	12,064	70,221	5,141	332	10,274	329	10,603
Chesterfield ...	Mar. 31, 1907	Dec., 1904	,,	5	68	95,000	68,528	26,472	68,529	11,714	65,000	2,557	...	10,989	503	11,492
Colchester ...	Mar. 31, 1907	July, 1904	,,	7	75	70,748	68,755	1,993	68,847	8,673	65,858	4,214	...	10,787	580	11,367
Croydon ...	Mar. 31, 1907	June, 1906	,,	19	44	336,611	254,010	82,601	270,043	13,813	224,234	35,276	...	61,091	975	62,066
Darlington ...	Mar. 31, 1907	June, 1904	,,	8	71	107,500	75,165	32,335	76,293	8,584	69,425	5,540	...	10,820	323	11,143
Darwen ...	Mar. 31, 1907	Oct., 1900	,,	7	13	93,400	85,400	8,000	85,436	11,928	73,879	13,658	1,150	13,327	681	14,008
Derby ...	Mar. 31, 1907	July, 1904	,,	E. 15	1	...	...	...	175,247	...	159,722	15,525	...	E 37,558	871	38,429
				H.		...	...	...	...	...	...	...	...	H 4,184	147	4,331
Doncaster ...	Mar. 31, 1907	June, 1902	,,	10	42	92,500	84,200	8,300	84,735	8,051	79,300	5,727	...	12,030	337	12,367
Douglas (I.O.M.)	Mar. 31, 1907	..	H.	3	40	54,020	54,020	...	55,514	8,882	49,166	4,889	3,000	20,220	1,314	21,534
			C.	2	60											
Dundee ...	May 15, 1907	July, 1900	E.	24	41	...	...	...	312,886	12,746	258,824	47,613	26,780	56,921	751	57,672
East Ham ...	Mar. 31, 1907	June, 1901	,,	12	61	160,442	160,133	309	164,064	12,855	146,323	20,775	3,442	46,435	653	47,088
Gloucester ...	Mar. 31, 1907	April, 1904	,,	12	41	151,000	126,000	25,000	127,326	10,186	123,333	3,993	...	14,192	841	15,033
				* 2	39											
Halifax ...	Mar. 31, 1907	June, 1898	,,	52	26	663,751	393,764	269,987	393,280	7,516	333,287	48,149	8,544	75,986	1,341	77,327
Ilford ...	Mar. 31, 1907	Mar., 1903	,,	11	28	142,603	142,396	207	142,396	12,546	129,549	13,054	6,532	24,478	912	25,390
Ipswich ...	Mar. 31, 1907	Nov., 1903	,,	14	70	116,471	110,000	6,471	114,334	7,687	106,098	4,674	...	21,262	780	22,042
Keighley ...	June 30, 1907	Oct., 1904	,,	6	9	50,934	46,004	4,930	46,004	7,526	39,891	6,827	1,641	8,019	222	8,241
Kilmarnock ...	May 15, 1907	Dec., 1904	,,	5	42	65,000	54,615	10,385	54,078	9,788	54,615	151	...	8,246	357	8,603
Kirkcaldy ...	May 15, 1907	Feb., 1903	,,	7	62	200,000	88,693	111,307	89,404	11,499	83,750	4,943	1,267	13,230	473	13,703
Lancaster ...	Mar. 25, 1907	Jan., 1903	,,	4	65	60,000	51,550	8,450	41,339	8,590	46,250	5,651	...	5,360	119	5,479
Leith ...	May 15, 1907	Aug., 1905	,,	11	76	225,000	171,345	53,655	179,796	15,046	179,062	6,873	...	26,380	643	27,033
Lincoln ...	Mar. 31, 1907	Nov., 1905	2	2	77	98,519	43,072	55,447	39,231	13,243	48,061	2,819	...	5,741	104	5,845
Liverpool ...	Dec. 31, 1906	Nov., 1898	E.	104	0	2,442,600	2,044,775	397,825	1,901,997	18,288	1,604,435	503,941	238,354	563,777	7,439	571,216
Lowestoft ...	Sep. 30, 1907	July, 1903	,,	5	79	129,230	79,231	49,999	79,231	13,233	75,135	5,076	...	10,937	349	11,286
Maidstone ...	Mar. 31, 1907	July, 1904	,,	2	23	25,000	25,000	...	26,255	11,477	25,005	1,250	2,000	5,650	241	5,891
Manchester ...	Mar. 31, 1907	June, 1901	,,	111	6	1,875,015	1,558,669	316,346	1,725,845	15,538	1,436,184	144,197	320,028	712,976	6,697	719,673
				*43	57											
				†14	54											
Nelson ...	Mar. 31, 1907	Feb., 1903	,,	3	69	38,000	35,662	2,338	35,662	9,233	33,291	2,371	...	7,264	55	7,319
Newport (Mon.) ...	Mar. 31, 1907	April, 1903	,,	14	40	264,500	189,819	74,681	199,424	13,753	180,461	18,003	1,046	32,547	652	33,199
Nottingham ...	Mar. 31, 1907	Jan., 1901	,,	35	58	730,300	581,734	148,566	581,734	16,284	473,128	116,340	53,668	137,998	1,995	139,993
Oldham ...	Mar. 25, 1907	May, 1902	,,	27	20	507,769	439,547	68,222	440,422	16,162	380,354	94,643	6,119	92,763	1,315	94,078
				* 8	31											
Perth ...	May 15, 1907	Nov., 1905	,,	8	40	70,000	73,400	...	74,879	8,809	70,450	3,710	...	7,985	411	8,396
Plymouth ...	Mar. 31, 1907	Sept., 1899	,,	15	0	182,856	174,906	7,950	215,986	14,399	132,872	45,355	29,126	31,256	10	31,266
Rochdale ...	Mar. 31, 1907	May, 1902	,,	24	45	354,491	345,000	9,491	343,246	13,974	345,000	16,231	...	53,830	308	54,138
				* 5	26											
Rotherham ...	Mar. 31, 1907	Jan., 1903	,,	10	0	228,550	112,500	116,050	123,914	12,391	104,040	8,517	9,181	26,917	819	27,736
Salford ...	Mar. 31, 1907	Oct., 1901	,,	36	40	1,192,246	669,583	522,663	574,853	15,749	626,609	125,701	46,146	232,551	...	232,551
				*38	20											
Southampton ...	Mar. 31, 1907	Jan., 1900	,,	16	22	202,539	172,397	30,142	200,183	12,300	164,242	35,659	690	49,636	1,368	51,004
Southport ...	Mar. 31, 1907	July, 1900	,,	10	61	292,000	196,500	95,500	195,412	9,930	157,230	39,270	6,773	18,176	307	18,483
				* 8	78											
South Shields ...	Mar. 31, 1907	Mar., 1906	,,	10	21	252,171	134,061	118,110	155,422	15,145	133,360	7,653	2,531	23,992	46	24,038
Stalyb'ge, Hyde, Mossley, & D'k'f'd	Mar. 31, 1907	May, 1904	,,	27	57	325,270	259,470	65,800	258,177	9,318	244,028	15,442	...	38,766	39	38,805
Sunderland ...	Mar. 31, 1907	Aug., 1900	,,	19	40	304,086	294,461	9,625	289,691	14,825	233,485	52,094	...	72,054	342	72,396
Wallasey ...	Mar. 31, 1907	Mar., 1902	,,	12	55	140,436	138,150	2,286	138,917	10,950	127,918	10,723	18,592	42,254	630	42,884
Walsall ...	Dec. 31, 1906	Dec., 1902	,,	15	2	188,144	151,000	37,144	142,947	8,366	145,900	6,162	...	26,400	546	26,946
				* 2	5											
Warrington ...	Mar. 31, 1907	April, 1902	,,	9	52	128,050	100,446	27,604	101,615	10,530	89,721	10,831	1,530	19,204	336	19,540
West Ham ...	Mar. 31, 1907	Feb., 1904	,,	26	35	509,119	353,753	155,366	547,989	20,728	531,494	11,822	19,548	116,793	2,982	119,775
Wigan ...	Mar. 31, 1907	April, 1901	,,	24	70	461,570	459,670	1,900	515,212	20,712	465,985	55,168	...	61,101	1,368	62,469
Wolverhampton	Mar. 31, 1907	April, 1902	2	20	0	279,228	245,861	33,367	254,606	12,730	227,359	17,260	18,051	43,183	640	43,823
				* 4	40							Motor Omnibuses		2,375	45	2,420
Yarmouth (Gt.) ...	Mar. 31, 1907	June, 1902	E.	12	4	144,500	110,000	34,500	110,363	9,159	101,791	5,424	1,197	21,390	512	21,902

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast ...	Mar. 31, 1907	Nov., 1905	E.	73	18	1,225,448	1,060,000	165,448	1,115,784	15,232	1,060,000	22,256	13,000	177,832	3,307	181,139
Bexley ...	Mar. 31, 1907	Oct., 1903	,,	6	73	98,259	96,984	1,275	94,858	13,723	90,854	6,130	...	11,419	1,569	12,988
Birkenhead	Mar. 31, 1907	Feb., 1901	,,	23	79	366,266	357,854	8,412	357,991	14,914	306,891	50,964	11,025	54,252	1,156	55,408
Bournemouth ...	Mar. 31, 1907	July, 1902	,,	34	35	381,554	381,554	...	401,668	11,664	368,221	35,518	24,993	83,663	360	84,023
				*10	0											
Cardiff ...	Mar. 31, 1907	May, 1902	,,	36	50	802,039	732,383	69,656	767,109	20,948	689,467	73,808	9,277	106,551	12,564	119,115
Glasgow ...	May 31, 1907	Oct., 1898	,,	165	47	3,100,000	2,227,353	872,647	3,104,061	18,746	1,679,974	547,379	1,122,104	887,381	8,461	895,842
				* 10	55											
Huddersfield ...	Mar. 31, 1907	Feb., 1901	,,	33	0	646,284	398,957	247,327	412,902	12,512	325,819	82,507	44,360	78,115	3,081	81,196
				* 3	20											
Hull ...	Mar. 31, 1907	July, 1899	,,	27	15	488,673	436,543	52,130	436,543	16,057	436,543	67,357	74,775	121,186	...	121,186
Leeds ...	Mar. 31, 1907	Aug., 1897	,,	96	50	1,340,374	1,340,374	...	1,303,815	13,494	1,167,263	213,248	33,270	323,913	3,891	327,794
Leicester ...	Dec. 31, 1906	May, 1904	,,	37	0	734,838	678,805	56,033	677,829	18,320	651,645	46,672	41,448	114,752	1,776	116,528
London ...	Mar. 31, 1907	May, 1903	1	H100	6	*	*	*	...	...	...	...	...	567,694	15,296	582,990
				E116	55				6,736,737	31,077	6,133,564	603,173	141,855	810,320	14,676	824,996
N'castle-on-Tyne	Mar. 31, 1907	Dec., 1901	E.	53	0	1,413,989	1,164,028	249,961	1,150,701	21,711	1,029,992	152,476	43,515	205,262	3,392	208,654
				*6	10											
Northampton ...	Mar. 31, 1907	July, 1904	,,	9	6	128,300	127,255	1,045	127,374	14,036	115,546	11,709	2,113	21,542	542	22,084
			H.	...		...	...	...	...	...	...	...	...	770	88	858
Portsmouth ...	Mar. 31, 1907	Sep., 1901	E.	28	40	672,272	661,714	10,558	670,157	23,514	618,341	100,715	48,695	98,911	3,103	102,014
Preston ...	Mar. 31, 1907	June, 1904	,,	17	16	224,102	187,269	36,832	187,269	10,888	167,775	14,487	9,907	37,796	150	37,946
Reading ...	Mar. 31, 1907	July, 1903	,,	13	15	231,658	231,658	...	220,783	16,742	204,993	22,548	7,466	32,661	972	33,633
Sheffield ...	Mar. 25, 1907	Sep., 1899	,,	66	28	1,163,646	1,133,770	29,876	1,172,279	17,683	970,620	136,278	74,245	276,907	2,679	279,586

E—Electric trolley system. H—Horse lines. C—Cable lines. * Indicates lines leased. † Lines on which running powers are exercised.
1 Horse, conduit, and electric. 2 Surface contact.
✱ Conferred by Annual Money Act, which limits amount for each financial year. Powers not exercised are lapsed.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name	Operating Expenses. Traffic.	General.	Repairs & Maintenance.	Power.	Total.	Net Income.	Additions to Net Income.	Deductions from Net Income. Interest.	Sinking Fund.	Income Tax.	Depreciation & Renewal	Sundries.	Total.	Net Surplus + or Deficit −
Aberdeen	16,734	6,548	6,008	9,361	38,651	28,036	4,134	10,985	3,515	...	16,737	933	32,170	...
Ayr	3,295	1,813	1,150	2,005	8,263	6,950	70	2,400	958	303	2,367	...	6,028	+ 992
Birmingham	27,311	9,298	6,028	25,602	68,239	68,185	...	18,447	6,547	...	14,660	16,531	56,185	+ 12,000
Blackburn	11,779	3,016	7,373	11,018	33,186	21,766	...	7,583	12,878	448	...	345	21,254	+ 512
Blackpool	10,648	3,646	6,199	9,399	29,892	21,614	3,480	8,590	6,349	113	6,042	...	21,094	+ 4,000
Bolton	25,322	6,443	13,209	16,589	61,563	49,731	753	12,993	13,573	..	14,693	146	41,405	+ 9,079
Bradford	62,245	19,909	31,785	45,644	159,583	72,524	3,232	25,020	29,484	2,543	4,536	4,173	65,756	+ 10,000
Brighton	13,047	3,652	6,558	11,243	34,500	16,153	...	8,579	5,164	...	...	...	13,743	+ 2,410
Burnley	14,251	4,833	6,971	15,237	41,292	21,512	...	5,855	4,834	...	8,766	2,057	21,512	...
Burton-on-Trent	4,738	1,634	1,721	2,845	10,938	4,594	418	2,004	1,978	...	1,000	907	5,889	− 877
Bury	11,719	3,877	4,018	8,471	28,085	22,564	244	7,658	5,253	385	2,500	6,002	21,798	− 1,715
Chester	2,752	1,309	506	1,946	6,513	4,090	...	2,436	1,287	..	367	...	4,690	...
Chesterfield	2,691	635	769	1,882	5,977	5,515	...	4,060		133	...	...	4,193	+ 1,322
Colchester	3,669	1,285	1,169	3,117	9,240	2,127	...	2,485	1,732	...	...	...	4,217	− 2,090
Croydon	17,515	4,862	6,798	12,597	41,772	20,294	401	6,238	4,804	600	9,053	...	20,695	...
Darlington	3,551	671	881	2,235	7,338	3,805	35	2,437	1,941	...	...	...	4,398	− 558
Darwen	3,208	731	1,900	2,780	8,619	5,389	...	2,407	2,048	...	1,050	...	5,505	− 116
Derby	E 11,179 H 1,497	2,043 163	2,055 337	7,111 2,929	22,388 4,926	16,041 ...	548	5,657	2,387	...	...	615	8,659	+ 7,930
Doncaster	3,509	994	1,634	3,597	9,734	2,633	...	2,651	1,249	95	...	...	3,995	− 1,362
Douglas (I.O.M.)	4,019	1,756	2,546	5,322	13,643	7,891	...	1,959	885	...	2,000	2,650	7,494	+ 397
Dundee	14,020	3,748	6,138	11,498	35,404	22,268	...	8,236	5,330	300	8,316	..	22,182	+ 86
East Ham	12,901	3,039	6,185	6,847	28,972	18,116	583	5,632	5,054	248	...	2,599	13,533	− 104
Gloucester	5,472	1,402	1,527	2,654	11,055	3,978	...	5,363	2,259	...	...	836	8,458	− 4,480
Halifax	19,530	7,616	11,776	18,960	57,882	19,445	1,180	12,782	8,588	457	...	475	22,302	− 1,677
Ilford	8,206	2,430	2,207	4,286	17,129	8,261	1,666	4,804	3,949	...	792	382	9,927	...
Ipswich	7,645	1,732	2,249	4,501	16,127	5,915	...	4,157	1,753	...	...	...	5,910	+ 5
Keighley	2,523	548	465	1,656	5,192	3,048	90	1,331	1,554	...	253	...	3,138	...
Kilmarnock	2,990	747	638	1,925	6,300	2,303	...	1,886	151	19	...	652	2,708	− 405
Kirkcaldy	4,330	822	720	3,212	9,084	4,619	...	2,916	2,103	...	409	184	5,612	− 993
Lancaster	2,264	863	673	1,823	5,623	...	90	1,554	1,229	...	...	* 144	...	− 2,837
Leith	8,883	2,482	2,368	4,153	17,886	9,137	62	5,906	6,873	...	...	150	12,929	− 3,729
Lincoln	1,436	844	522	1,027	3,829	2,016	...	1,150	1,368	...	...	...	2,518	− 502
Liverpool	148,668	54,452	82,367	99,918	385,405	185,811	12,403	53,244	56,337	...	55,171	5,877	170,629	+ 27,585
Lowestoft	3,658	859	1,418	3,180	9,115	2,171	.	2,607	1,332	...	...	...	3,939	− 1,768
Maidstone	1,352	656	514	1,509	4,031	1,860	122	983	625	...	...	...	1,608	+ 374
Manchester	196,785	63,374	63,270	131,264	454,693	264,980	1,911	50,141	39,594	4,769	87,827	29,560	211,891	+ 55,000
Nelson	2,111	383	868	2,105	5,467	1,852	...	1,072	765	76	...	...	1,913	− 61
Newport (Mon.)	7,423	3,039	4,927	6,488	21,877	11,322	2,184	7,838	4,140	99	45	...	12,122	+ 1,384
Nottingham	33,457	12,553	12,563	22,483	81,056	58,937	...	15,889	16,493	...	...	2,811	35,193	+ 23,744
Oldham	20,089	4,317	8,148	21,582	54,136	39,942	1,110	12,436	13,227	277	..	6,447	32,387	+ 8,665
Perth	2,505	677	140	1,741	5,063	3,333	47	2,634	1,892	2	...	...	4,528	− 1,148
Plymouth	6,811	2,728	5,153	7,170	21,862	9,404	1,225	4,624	4,727	...	...	1,278	10,629	..
Rochdale	13,656	2,323	4,361	9,165	29,505	24,633	...	10,448	6,907	772	...	3,613	21,740	+ 2,893
Rotherham	7,566	2,215	2,171	6,899	18,851	8,885	1,463	3,737	2,260	...	4,201	150	10,348	..
Salford	61,281	14,543	21,165	45,177	142,166	90,385	4,439	20,452	18,691	1,446	14,889	26,346	81,824	+ 13,000
Southampton	14,032	4,495	7,024	11,019	36,570	14,434	...	6,222	5,192	212	2,535	273	14,434	...
Southport	4,508	1,648	1,832	3,238	11,226	7,257	6,325	6,434	4,946	...	1,977	150	13,507	+ 75
South Shields	5,038	1,852	988	4,260	12,138	11,900	111	4,504	2,859	...	2,531	2,117	12,011	...
Stalybridge, Hyde, Mossley, & D'kinf'd	14,906	3,737	4,117	9,180	31,940	6,865	...	8,949	6,115	...	...	...	15,064	− 8,159
Sunderland	18,417	5,406	4,159	12,840	40,822	31,574	704	8,751	9,014	469	6,259	661	25,154	+ 7,124
Wallasey	11,716	3,190	3,346	8,914	27,166	15,718	221	4,873	2,634	...	3,000	553	11,060	+ 4,879
Walsall	6,849	2,418	2,862	3,965	16,094	10,852	1,053	5,099	2,148	269	4,389	...	...	...
Warrington	4,936	1,460	2,178	3,813	12,447	7,093	127	3,195	2,715	...	...	...	5,910	+ 1,310
West Ham	39,667	7,858	9,084	15,810	72,419	47,356	162	14,902	7,444	650	7,722	2,810	33,528	+ 13,990
Wigan	15,416	8,038	10,560	14,807	48,821	13,648	...	18,450	10,260	...	...	1,330	30,040	− 16,392
Wolverhampton	780 10,014	116 3,313	858 3,793	409 7,417	2,154 24,537	266 19,286	... 719	... 7,808	... 4,130	... ...	... 5,783	... 359	... 18,080	... + 2,191
Yarmouth (Gt.)	6,547	1,859	1,922	3,942	14,270	7,632	...	3,376	1,962	...	...	...	5,338	+ 2,294

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast	54,732	12,296	20,277	15,953	103,258	77,881	111	34,339	21,175	...	13,000	...	68,514	+ 9,478
Bexley	3,229	1,314	1,645	2,658	8,846	4,142	127	3,132	1,810	...	...	...	4,942	− 673
Birkenhead	15,049	5,092	7,506	5,858	33,505	21,903	...	11,891	9,289	200	317	206	21,903	...
Bournemouth	22,562	6,175	10,134	14,570	53,441	30,582	1,874	12,185	12,756	...	...	6,664	31,425	+ 1,031
Cardiff	36,893	9,384	11,802	7,094	65,174	49,185	...	23,138	19,729	...	...	1,913	44,780	+ 4,405
Glasgow	245,021	86,791	122,126	31,318	485,256	410,586	3,510	63,769	49,777	9,932	168,408	51,931	343,817	+ 70,279
Huddersfield	18,959	3,931	12,086	5,065	40,041	41,155	303	12,185	9,808	806	12,427	1,206	36,432	+ 5,026
Hull	30,592	8,933	21,301	9,352	70,178	51,008	818	12,942	9,528	1,224	10,604	...	34,298	+ 17,528
Leeds	87,112	29,403	37,440	17,255	171,210	156,584	9,512	43,005	38,029	3,946	11,481	373	96,834	+ 69,262
Leicester	41,903	8,823	10,057	8,157	68,940	47,588	551	22,761	11,872	396	13,110	...	48,139	...
London	H 202,483 E 213,906	69,981 88,654	52,221 84,065	259,683 81,478	584,368 468,103	... 356,893	... 4,424	174,778	153,155	1,425	35,000	22,285	386,643	− 25,336
N'castle on-Tyne	56,004	16,536	20,482	13,060	106,882	102,572	3,071	34,323	34,255	4,366	335	3,924	75,959	+ 28,440
Northampton	E 5,763 H ...	1,894 ...	1,339 ...	2,290 ...	11,286 1,245	10,798 ...	110 ...	... 4,353	... 3,728	... ..	... 1,355	... 472	... 9,908	... + 1,600
Portsmouth	26,501	7,660	6,029	5,565	45,755	56,259	353	19,697	16,217	1,109	6,261	4,303	47,587	+ 9,625
Preston	10,071	4,505	4,004	2,203	20,783	17,163	...	5,822	5,773	..	5,568	...	17,163	..
Reading	8,515	3,725	2,618	3,405	18,263	15,370	...	6,558	5,607	145	3,060	...	15,370	...
Sheffield	97,590	20,245	29,662	20,922	168,419	111,167	812	41,393	25,716	2,203	20,000	2,000	91,312	+ 20,667

H—Horse lines. E—Electric trolley lines. * Deficit on Revenue Account.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Appropriation of Net Surplus. Carried Forward.	Reserve.	Relief of Rates.	Population Served.	Car Mileage.	Passengers Carried.	Passengers Carried per Car Mile.	Average Fare per Passenger. d.	Average Journeys per Head of Populat'n per Annum.	Average Car Miles per Day per Car.	Average Total Revenue per Car Mile. d.	Average Traffic Revenue per Car Mile. d.	Traffic Revenue per Mile of Single Track.	Average Traffic Revenue per Annum per Head of Populat'n Served.	Operating Expenses per Passenger. d.	Percentage of Operating Expenses to Total Revenue. %
Aberdeen	...	...	...	167,000	1,529,682	17,676,008	11·55	·95	105·84	95	11·112	10·332	2,522	8/4	·52	54·57
Ayr	...	992	...	33,000	378,884	3,603,789	9·51	·98	109·20	104	9·637	9·294	1,520	8/11	·55	54·31
Birmingham	12,000															
Blackburn	512	...	...	200,000	1,002,372	10,094,028	10·07	1·25	50	105	13·15	12·64	2,219	5/3	·80	61·01
Blackpool	...	...	4,000	...	958,836	8,304,218	8·66	1·58	...	109	12·89	12·65	2,380	...	·864	58·04
Bolton	...	...	9,079	221,000	2,411,969	23,410,690	9·70	1·14	105·93	111·21	11·07	11·03	2,650	10/5	·63	55·40
Bradford	...	...	10,000	324,000	5,167,261	46,728,977	9·043	1·17	144	104·09	10·78	10·566	2,347	11/5	·819	68·16
Brighton	2,410	...	...	128,095	1,118,590	10,759,310	9·62	1·09	84	87·68	10·86	10·49	2,844	7/8	·77	68·11
Burnley	...	...	...	165,000	1,205,830	11,967,498	9·92	1·31	73	100	12·50	12·35	3,159	7/6	·83	65·86
Burton-on-Trent	...	...	...	52,000	421,317	3,383,527	8·03	1·072	65	58	8·85	8·60	1,529	5/10	·78	70·42
Bury	...	...	2,725	124,726	1,276,227	9,944,897	8	1·22	79·73	123·33	9·525	9·500	1,854	8/1	·677	55·45
Chester	...	...	...	38,309	291,555	2,532,778	8·687	·97	66·12	92	8·731	8·460	2,854	5/4	·62	63
Chesterfield	922	...	400	38,000	275,417	2,302,097	8·36	1·13	60	125	10·01	9·58	1,900	5/9	·62	53
Colchester	...	...	...	40,540	353,331	2,514,589	7·11	1·02	62·02	86	7·721	7·327	1,522	5/4	·88	81·5
Croydon	...	...	...	154,342	1,502,408	13,514,918	8·99	1·08	87·56	103	9·915	9·76	3,125	7/11	·742	66·87
Darlington	...	...	...	50,000	372,912	3,169,036	8·5	·82	63·38	92·9	7·171	6·964	1,217	4/4	·556	65·85
Darwen	...	...	...	41,864	240,893	2,562,234	10·63	1·2	61	71·09	13·956	13·277	1,861	6/4	·807	61·53
Derby	7,930	...	...	124,000	E. 849,248 H. 109,023	8,381,460 1,004,914	9·869 9·222	1·075 ·999	75·70	...	10·86 9·529	10·614 9·205	...	6/9	·64 1·17	58·26 113·71
Doncaster	...	...	...	41,500	495,404	2,753,506	5·55	1·05	66·35	122	5·991	5·828	1,143	5/9	·85	78·71
Douglas (I.O.M.)	397	...	...	...	H. 286,513 C. 121,333	2,161,667 700,227	7·017	1·696	...	70 Sum. 79 ,,	12·672	11·899	3,235	...	1·144	63·36
Dundee	...	86	...	164,500	1,162,792	15,554,905	13·3	·878	93	81	11·903	11·748	2,323	6/11	·546	61·38
East Ham	...	...	5,270	125,000	1,062,151	15,049,240	14·1	·74	120	108	10·64	10·492	3,638	7/5	·50	61·53
Gloucester	...	...	...	50,715	519,996	3,182,111	6	1·06	62·75	94·93	6·938	6·55	948	5/7	·83	73
Halifax	...	...	...	178,000	1,624,275	18,899,242	11·62	·97	106	78	11·425	11·228	1,474	8/6	·735	74·85
Ilford	...	...	...	70,000	645,117	6,586,754	10·2	·89	94	126	9·446	9·106	2,156	7/-	·624	67·46
Ipswich	5	...	...	73,000	654,253	5,289,006	8·08	·965	75·56	70·65	8·086	7·8	1,429	5/10	·73	73·16
Keighley	...	...	...	42,000	256,715	1,935,098	7·50	·994	46·07	100·41	7·704	7·497	1,312	3/10	·644	62
Kilmarnock	...	...	...	36,000	328,829	2,331,277	7·09	·84	64·76	98·80	6·279	6·018	1,492	4/7	·654	73·75
Kirkcaldy	...	...	...	34,063	466,919	4,640,618	9·939	·692	136·2	53	7·556	7·289	1,734	7/9	·47	66·29
Lancaster	...	...	...	44,600	194,577	1,353,681	6·96	·950	30·35	92	6·759	6·611	1,117	2/5	·997	108
Leith	...	...	...	113,251	861,162	8,519,563	9·9	·74	75·23	112	7·531	7·352	2,208	4/8	·504	66·22
Lincoln	...	...	...	52,500	137,186	1,437,946	10·48	·95	27·39	55	10·226	10·044	1,938	2/2	·64	65·50
Liverpool	...	...	27,585	770,000	12,115,934	122,094,528	10·07	1·108	158·56	106	11·315	11·168	5,421	14/8	·766	67
Lowestoft	...	...	...	31,000	343,190	2,622,922	7·64	1·00	84·61	67	7·89	7·65	1,827	7/-	·83	87·64
Maidstone	374	...	...	13,000	157,050	1,186,566	8·85	1·14	91·27	92·5	9·002	8·633	710	8/8	·81	68·44
Manchester	...	...	55,000	800,000	15,523,459	143,264,501	9·23	1·19	179	100	11·12	11·02	4,556	17/10	·76	63·18
Nelson	...	...	...	42,000	203,203	2,035,300	10·01	·86	48·46	93	8·645	8·580	1,881	3/5	·645	74·70
Newport (Mon.)	1,384	...	...	75,000	772,753	7,760,404	10·04	1·007	100·81	100	10·311	10·108	2,245	8/8·15	·677	65·90
Nottingham	...	6,744	17,000	254,568	2,731,552	31,218,691	11·43	1·06	123	95·50	12·30	12·13	3,863	10/10	·62	58
Oldham	...	3,665	5,000	160,000	1,818,444	18,647,731	10·25	1·19	116·55	104	12·416	12·243	2,604	11/7	·697	57·54
Perth	...	...	...	34,000	229,551	1,681,188	7·32	1·14	49·45	91	8·779	8·349	939	4/8	·723	60·3
Plymouth	...	...	...	118,000	721,115	7,324,347	10·157	1·024	62·07	90	10·406	10·403	2,084	5/4	·72	69·92
Rochdale	2,893	...	...	102,614	1,201,364	9,749,202	8·11	1·32	95	105	10·814	10·753	1,804	10·6	·73	55
Rotherham	...	...	...	61,500	618,211	5,743,298	9·29	1·125	93·39	109·56	10·767	10·450	2,692	8/9	·788	67·97
Salford	...	...	13,000	350,000	5,268,933	43,614,123	8·27	1·27	124·6	115·5	10·594	10·594	3,102	13/3	·782	59·99
Southampton	...	...	...	117,300	1,143,085	9,437,396	8·256	1·251	80	70	10·709	10·421	3,050	8/6	·93	71·70
Southport	75	...	...	31,312	447,821	4,068,131	9·08	1·07	129·9	102·5	9·905	9·741	1,691	11/7	·66	60
South Shields	...	...	...	112,000	559,948	5,654,929	10·09	1·01	50·48	99	10·30	10·28	2,337	4/3	·515	50·59
Stalybridge, &c.	...	...	...	92,811	1,422,122	9,780,464	6·877	·951	101·88	95·03	6·548	6·542	1,399	8/4	·784	82·3
Sunderland	...	...	7,124	170,000	1,535,425	17,483,132	11·38	1·006	102	76·8	11·314	11·261	3,687	8/6	·56	55·66
Wallasey	1,539	...	3,340	65,000	862,123	7,995,451	9·27	1·27	123	81·4	11·94	11·76	3,330	13/-	·816	62·60
Walsall	...	...	...	100,000	611,687	4,814,657	7·592	1·316	48	102	10·572	10·358	1,955	5/3	·82	59·727
Warrington	...	1,310	...	83,000	429,786	4,965,296	11·55	·93	59·82	103·42	10·911	10·724	1,989	4/7	·60	63·7
West Ham	4,322	...	9,668	308,284	2,556,854	35,502,836	13·88	·789	115	87	11·243	10·963	5,159	7/7	·492	60·00
Wigan	...	...	...	61,000	1,452,458	11,269,947	7·76	1·26	185	83	10·32	10·09	2,456	20/-	1·04	78
Wolverhampton	2,191	...	...	100,900	966,133	9,276,023	9·601	1·179	91·93	90	10·886	10·727	1,763	9/-	·691	57·72
Yarmouth (Gt.)	2,294	...	...	35,000	601,535	4,296,953	7·143	1·199	122·77	73·97	8·737	8·534	1,775	12/3	·798	65·15

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast	516	...	8,962	349,180	5,296,895	42,945,849	8·11	·99	123	128	8·21	8·06	2,473	10/4	·58	57
Bexley	...	...	...	16,300	268,619	1,737,204	6·46	1·70	106·58	...	11·604	10·202	1,652	14/-	1·22	68·11
Birkenhead	...	...	...	117,000	1,324,743	11,696,691	8·82	1·113	100·83	83·32	10·038	9·829	2,261	9/3	·687	60·84
Bournemouth	1,031	...	...	100,000	1,765,098	13,503,610	7·65	1·48	135	92	11·42	11·37	2,860	16/9	·95	63·65
Cardiff	4,405	...	...	164,333	2,624,504	24,438,164	9·31	1·046	148·71	99	10·893	9·744	2,910	12/11	·653	55·83
Glasgow	...	25,279	45,000 *	1,050,000	20,350,367	224,063,098	11·01	·95	213	101·20	10·565	10·465	5,035	16/11	·52	53·96
Huddersfield	5,026	...	...	120,000	1,794,691	15,252,150	8·50	1·22	127	112	10·79	10·38	2,770	13/-	·63	49·32
Hull	15,000	...	2,528	266,762	2,956,406	29,151,543	9·86	1·00	109	113·68	9·84	9·84	4,456	9/1	·58	57·89
Leeds	...	...	69,262	463,495	7,454,321	73,024,853	9·92	1·065	157·55	111·58	10·69	10·56	3,352	14/-	·563	52·23
Leicester	...	...	...	232,111	3,331,998	27,467,984	8·243	1·002	118	99	8·393	8·265	3,101	9/11	·60	59
London	...	...	...	...	H13,862,718 E16,267,579	131,165,027 183,062,063	9·46 11·25	1·04 1·06	... ...	82 106	10·093 12·171	9·828 11·955	5,762 6,944	... ...	1·069 ·614	100·24 56·74
N'castle-on-Tyne	...	14,856	13,584	300,000	4,263,174	45,506,468	10·67	1·11	152	106	11·75	11·56	3,871	13/8	·57	50·84
Northampton	...	...	1,000	90,000	E. 541,715 H. 31,864	5,216,883 184,072	9·63 7·77	·99 1·00	60 ...	90 ...	E. 9·78 H. 6·46	9·53 5·80	2,459 ...	4/11 ...	·519 1·624	E. 51·10 H. 145·27
Portsmouth	4,025	...	5,000	202,000	2,199,823	20,668,825	9·40	1·15	102·32	83	11·129	10·791	3,471	9/9	·531	44·85
Preston	...	...	...	120,000	904,582	8,459,742	9·35	1·072	70·5	132·92	10·068	10·028	2,197	6/3	·59	54·77
Reading	...	...	...	80,000	918,825	8,130,179	8·84	·96	110	112	8·78	8·53	2,476	7/10	·53	54
Sheffield	...	...	20,667	447,951	6,804,656	73,966,299	10·870	·898	165	104·6	9·861	9·767	4,174	12/4	·546	60·24

* Applied as special depreciation. H—Horse lines. E—Electric trolley system.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Average Operating Expenses per Car Mile (excludi'g Power Cost). d.	Average Operating Expenses per Car Mile (including Power Cost). d.	Average Number of Cars in Use Daily.	Number of Cars in Stock.	Average Speed per Hour. Miles.	Average Car Hours per Day.	Average Distance of 1d. Fare. Miles.	Average Fare Charged per Mile. d.	Operating Expenses per Car Mile. Traffic. d.	General. d.	Repairs and Mainten-ance. d.	Power. d.	Total. d.	Board of Trade Units.	Cost per Board of Trade Unit. d.	Board of Trade Units used per car mile.
Aberdeen	4·595	6·064	44	69	7	704	1·31	·81	2·625	1·027	·943	1·469	6·064	1,906,218	1·17	1·25
Ayr	3·964	5·234	10	19	8	130	1·25	·75	2·087	1·148	·729	1·270	5·234	375,436	1·28	·99
Birmingham ...																
Blackburn	5·38	8·02	26	48	7·50	364	1·25	·76	2·82	·72	1·76	2·64	7·04	1,853,272	1·43	1·84
Blackpool	5·13	7·48	24	61	6	400	...	...	2·67	·91	1·55	2·35	7·48	1,261,946	1·79	1·31
Bolton	4·47	6·12	58	96	7½	932	1·40	·70	2·518	·639	1·313	1·656	6·126	3,619,390	1·10	1·50
Bradford	5·292	7·412	136	239	7·20	2,040	1·59	·501	2·891	·925	1·476	2·120	7·412	9,582,871	1·14	1·8
Brighton	4·99	7·40	32	50	6½	512	1·31	·72	2·799	·784	1·407	2·412	7·402	1,798,905	1·50	1·61
Burnley	5·18	8·218	27	46	7	405	1·25	·83	2·836	·963	1·387	3·032	8·218	2,525,135	1·45	2·08
Burton-on-Trent...	4·61	6·23	9·79	20	6¾	181	1·35	·70	2·70	·93	·98	1·62	6·23	551,758	1·385	1·16
Bury	3·689	5·282	..	47	7·56	...	1·22	·83	2·204	·729	·756	1·593	5·282	2,042,840	·99	1·6
Chester	3·762	5·364	6·4	13	8	115	1·27	·79	2·265	1·078	·419	1·602	5·364	266,856	1·75	·91
Chesterfield ...	3·56	5·20	6	12	7·15	108	1·38	·75	2·344	·554	·670	1·641	5·209	361,421	1·25	1·31
Colchester	4·159	6·276	10·68	18	6·12	171	1·13	·97	2·492	·873	·794	2·117	6·276	498,758	1·50	1·41
Croydon	4·661	6·673	48	60	6·85	725	2·15	·52	2·798	·777	1·086	2·012	6·673	1,511,590	2·00	1·006
Darlington	3·284	4·723	11	16	6½	151	1·098	·82	2·285	·432	·567	1·439	4·723	429,105	1·25	1·15
Darwen	5·817	8·587	6	17	8·75	108	1·05	·81	3·196	·728	1·893	2·770	8·587	395,096	1·75	1·64
Derby	E. 4·318 H. ...	6·327 10·837	... ...	39 5	... ...	... ...	... ...	... ...	3·16 3·294	·577 ·358	·581 ·741	2·009 6·444	6·327 10·837	1,137,705	1·50	1·34
Doncaster	2·974	4·716	13	25	7·5	222	1·25	·8	1·7	·482	·792	1·742	4·716	575,470	1·50	1·16
Douglas (I.O.M.) ..	4·897	8·029	H 24 Sum. C 9 ,,	43 14	6	...	1·5 1·37	1·23 Sum. 1·45 ,,	2·365	1·033	1·499	3·132	8·029			
Dundee	4·934	7·307	42	60	6·2	528	1·468	·786	2·893	·774	1·267	2·373	7·307	2,207,559	1·25	1·8
East Ham	4·999	6·546	25	40	7	448	1·57	·64	2·915	·687	1·397	1·547	6·546	1,095,511	1·5	1·03
Gloucester	3·87	5·10	15	30	6·78	217	1·50	·62	2·526	·646	·705	1·225	5·102	637,491	1·00	1·21
Halifax	5·751	8·552	57	96	7·2	912	1·30	·77	2·886	1·125	1·740	2·801	8·552	3,033,499	1·50	1·87
Ilford	4·778	6·372	14	22	7·5	221	1·373	·74	3·053	·904	·821	1·594	6·372	897,916	1·146	1·392
Ipswich	4·265	5·916	19	36	6·30	216	1·53	·693	2·805	·635	·825	1·651	5·916	720,246	1·50	1·101
Keighley	3·306	4·854	7	12	7·61	126	2·35	·994	2·359	·513	·434	1·548	4·854	227,137	1·75	·88
Kilmarnock ..	3·193	4·598	9·11	14	7·43	121	1	·97	2·182	·545	·466	1·405	4·598	369,551	1·25	1·12
Kirkcaldy	3·305	4·956	18	22	6½	184	1·50	·64	2·437	·462	·406	1·651	4·956	685,269	1·125	1·467
Lancaster	4·687	6·936	6	12	8	96	1·019	·959	2·793	1·064	·830	2·249	6·936	240,820	1·817	1·238
Leith	3·828	4·985	21	37	7	315	1·56	·63	2·476	·692	·66	1·157	4·985	971,699	1·026	1·13
Lincoln	4·903	6·699	4	8	7	72	1·75	·428	2·513	1·477	·913	1·796	6·699	164,314	1·50	1·197
Liverpool	5·655	7·635	389	494	8	5,446	2·375	·43	2·945	1·079	1·631	1·980	7·635	20,381,934	1·177	1·682
Lowestoft	4·15	6·37	14	19	8	196	univ'rs'l penny fare		2·56	·60	·99	2·22	6·37	356,551	2·14	1·04
Maidstone	3·854	6·160	5	7	6·4	71·66	1	1	2·066	1·002	·786	2·306	6·16	206,932	1·75	1·31
Manchester ..	5·00	7·03	425	566	7·37	6,175	2·12	·56	3·04	·98	·98	2·03	7·03	25,072,791	1·259	1·61
Nelson	3·971	6·457	6	9	10	108	1	1	2·494	·452	1·025	2·486	6·457	252,546	2	1·24
Newport (Mon.) ..	4·779	6·794	26	40	6·67	390	1·62	·61	2·305	·944	1·530	2·015	6·794	1,153,398	1·35	1·49
Nottingham ..	5·14	7·12	77	115	6·50	15	1·62	·65	2·94	1·10	1·10	1·98	7·12	4,316,656	1·25	1·61
Oldham	4·297	7·145	48	80	6·50	864	1·12	·871	2·652	·570	1·075	2·848	7·145	3,453,037	1·50	1·89
Perth...	3·473	5·294	8	12	6·25	120	1·01	1·073	2·619	·708	·146	1·821	5·294	279,694	1·49	1·21
Plymouth	4·999	7·276	28	42	7·25	336	1·75	·75	2·267	·908	1·715	2·386	7·276	938,006	1·75	1·34
Rochdale	4·065	6·028	33	59	7	495	1·14	·95	2·725	·462	·878	1·828	5·893	1,896,278	1·16	1·69
Rotherham ..	4·640	7·318	17	31	8	272	1·6	·62	2·937	·860	·843	2·678	7·318	1,103,804	1·50	1·785
Salford	4·418	6·476	125	177	7·75	2,125	1·50	·59	2·791	·662	·965	2·058	6·476	7,983,603	1·358	1·53
Southampton ..	5·366	7·679	45	51	7	557	1·25	·75	2·947	·944	1·475	2·313	7·679	1,333,050	1·98	1·17
Southport	4·282	6·017	14	26	6·5	210	1·3	·72	2·415	·883	·981	1·735	6·016	504,385	1·50	1·16
South Shields ..	3·37	5·20	15	35	6·89	222	1·50	·62	2·16	·79	·42	1·83	5·20	710,234	1·44	1·27
Stalybridge, etc...	3·840	5·389	41	55	6·75	577	1·24	·8	2·515	·630	·695	1·549	5·389	2,203,128	1·0	1·549
Sunderland ..	4·374	6·379	45	70	7	726	1·44	·68	2·879	·845	·650	2·005	6·379	1,826,167	1·69	1·18
Wallasey	5·082	7·562	29	35	7	435	1·50	·62	3·26	·89	·931	2·48	7·562	1,316,215	1·62	1·32
Walsall	4·760	6·314	17	28	7	255	1·24	·83	2·687	·949	1·123	1·555	6·314	662,582	1·50	1·063
Warrington ..	4·821	6·950	11·386	21	6·46	182·17	1·25	·803	2·790	·815	1·216	2·129	6·950	610,115	1·50	1·42
West Ham	5·314	6·798	80	100	6¾	1,040	1·85	·56	3·723	·738	·853	1·484	6·798	3,797,337	·99	1·48
Wigan	5·62	8·07	48	67	8	960	1	1	2·543	1·33	1·75	2·45	8·07	2,369,000	1·50	1·63
Wolverhampton ..	4·252	6·095	30	43	6½	420	1·125	·867	2·487	·823	·942	1·843	6·095	1,582,325	1·125	1·638
Yarmouth (Gt.) ...	4·12	5·693	22	31	6	324	1	1	2·612	·742	·766	1·573	5·693	539,902	1·75	·897

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

															Works Cost.	
Belfast	3·96	4·68	199	232	8·75	1,931	2·33	·40	2·48	·56	·92	·72	4·68	6,434,835	·89	1·21
Bexley	5·529	7·904	...	16	7·5	...	1·31	·80	2·885	1·174	1·470	2·375	7·904	408,497	1·561	1·52
Birkenhead ..	5·009	6·07	43·55	59	7·128	509	1·38	·64	2·727	·922	1·360	1·061	6·070	2,398,274	·58	1·81
Bournemouth ...	5·29	7·27	57	81	6·61	1,026	1·16	·87	3·07	·84	1·38	1·98	7·27	2,676,833	1·306	1·51
Cardiff	5·311	5·95	87	130	6·50	1,104	2	...	3·374	·858	1·079	·64	5·95	4,842,074	·35	1·84
Glasgow	5·353	5·721	543·98	780	7·91	7,616	2·29	·45	2·890	1·023	1·440	·369	5·721	24,974,056	·301	1·23
Huddersfield ...	4·65	5·32	44·25	70	6·6	708	1·25	·82	2·52	·52	1·61	·67	5·32	3,722,598	·33	2·04
Hull	4·93	5·69	71·25	116	10	1,140	2·75	·36	2·48	·73	1·72	·76	5·69	3,582,831	·63	1·21
Leeds	5·02	5·58	186	270	7·21	2,790	1·95	·54	2·84	·96	1·22	·56	5·58	13,091,475	·32	1·78
Leicester	4·377	4·965	92	140	8	1,472	2·15	·493	3·018	·635	·724	·588	4·965	5,349,665	·358	1·60
London	H 5·622 E 5·704	10·117 6·906	466 420	723 671	6 8·5	6,291 6,300	... ...	... ...	3·506 3·156	1·212 1·308	·904 1·240	4·495 1·202	10·117 6·906	32,782,702	·596	2·02
N'castle-on-Tyne...	5·23	6·04	111	187	7	1,665	1·58	·65	3·15	·93	1·15	·74	5·97	7,659,050	·41	1·80
Northampton ...	3·99	5·00	16·50	22	5·6	264	1·34	·68	2·55	·85	·59	1·01	5·00	878,889	·625	1·62
Portsmouth ...	4·384	4·991	73	100	6	15	1·50	·85	2·891	·835	·658	·607	4·991	2,230,460	·599	1·378
Preston	4·929	5·514	20	30	7·36	360	1	·95	2·671	1·195	1·063	·585	5·514	1,461,304	·362	1·409
Reading	3·88	4·77	25	36	7	400	1·47	·69	2·224	·973	·684	·889	4·770	1,090,416	·75	1·053
Sheffield	5·202	5·940	178·23	263	6·727	2,940	2·50	·38	3·442	·714	1·046	·738	5·940	11,546,500	·391	1·637

C—Cable line. E—Electric trolley system. H—Horse lines. * And general.

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FINANCIAL REPORTS.

Brush Electrical Engineering Company.—Mr. Justice Neville, in the Chancery Division of the High Court of Justice on April 4 made an order sanctioning the reduction of the capital of this company by £170,484.

New South Wales Tramways.—The revenue of the New South Wales Government tramways for the March quarter was £264 318, as compared with £235,138 for the corresponding quarter of last year. The expenditure amounted to £196,256, against £167,807.

Madras Electric Tramways (1904) Limited.—The directors in their report recommend a dividend of 4½ per cent. per annum (2s. 3d. per share) on the preferred ordinary shares for the past half-year, to place £1,500 to depreciation and renewal fund, and to carry forward £221.

Chester Tramways.—Mr. F. J. Beckett, Chester city accountant, has presented his report on the past year's working of the Corporation tramways. The traffic revenue was £11,844, and after paying working expenses there was a surplus of £4,583. The meeting of debt charges, etc., reduced this to £448.

Wemyss and District Tramway Company.—The directors' report for 1907 shows that the total revenue was £13,111. and after paying working expenses and debenture interest, and transferring £1,500 to depreciation reserve fund, there was a credit balance of £1,866. The business of the company is rapidly expanding.

Manchester Estimates.—On April 14 Manchester Tramways Committee considered estimates for the year now beginning. The income is anticipated at £913,662, as compared with £769,188 in the past year, and it is hoped to hand over £80,000 in relief of the rates, or £5,000 more than last year. Capital expenditure on new cars, sheds, etc., is put at £78,000, as against £44,453 last year.

Colombo Electric Tramways and Lighting Company.—The directors propose a dividend of 4 per cent., free of income tax, for the past year, to place £5,111 to reserve and renewal fund, from which £13,000 has been taken to write down the track renewal account. and £1,000 to extinguish the mains and plant improvement account, carrying forward £935.

Greenock and Port Glasgow Tramways Company.—The total revenue for 1907 was £34.358, and the total expenses £25,592. £8,903 remains available for distribution, and the directors recommend payment of the preference dividend, and a dividend of 3 per cent. on the ordinary shares. The decline in the local shipbuilding industry continues, and a further reduction in the receipts for 1908 must be anticipated.

Rossendale Valley Tramways Company.—The report of the directors for the year ended December 31 last shows that the receipts were £10,711, and the working expenses £7,533. The board declares a dividend on the preference shares at the rate of 5 per cent. per annum, and a dividend at the same rate on the ordinary shares. A sum of £500 is placed to reserve, and £193 is carried forward. The local authorities have given notice to purchase the tramways.

Cork Electric Tramways and Lighting Company.—The report of the directors for 1907 states that the receipts were £51,513 and the expenses £31,797, giving a surplus of £19,716. Adding £703 brought forward, and deducting £4,600 interest on debentures, there is an available balance of £15,819. Out of this, £6,145 has been paid as dividends on the preference shares, £2.500 has been added to reserve for depreciation, and £2.990 has been written off wiring consumers' premises, cables, etc. The balance is now utilised to pay a dividend of 3 per cent. on the ordinary shares, with £734 over, which is carried forward.

Rothesay Tramways Company.—The report of the directors for the year ended December 31 last states that the board have debited revenue account and credited depreciation and renewals reserve with the sum of £1,000. The total revenue for the year was £11,051. After deducting all expenses, including £2,864 for debenture and other interest, and after setting aside the £1,000 above referred to, there remains a balance of £1,086, making, with the £325 brought forward, an amount of £1,411 available for distribution. The directors recommend a dividend at the rate of 2 per cent. on the ordinary shares, leaving to be carried forward £133.

Willans and Robinson, Limited.—The report for the half-year ended December 31 states that after writing off £6,711 for depreciation the Rugby works show a profit of £22,946, but at the Queen's Ferry works there was a loss of £3,128. The net profit is therefore £19,817, which, with the £2,708 brought forward, makes a total of £22,526. The directors propose to pay a dividend at the rate of ten per cent. per annum on the ordinary shares, and to carry forward £7,443. The directors have strong hopes that the sale of the Queen's Ferry works may be effected upon reasonable terms in the near future.

Bath Electric Tramways, Limited.—The report of the directors for the year ended December 31 last states that the decrease in earnings may be wholly attributed to the unsatisfactory weather conditions prevailing during 1907. After charging the expenses of operation and administration, there remains a balance of £13,368, which, with the balance brought forward of £380, makes a total of £13,748, from which have to be deducted interest on 4½ per cent. first mortgage debenture stock paid and accrued to date £6,075, interest on loans £1,435, and the dividend on the preference shares for the year, £3,750, leaving a balance of £2,489, which the directors recommend should be carried forward.

Oldham, Ashton, and Hyde Electric Tramway, Limited.—The report of the directors for 1907 states that the board have debited the profit and loss account with £1,716 to be placed to a provision for renewals account. The total revenue for the year amounts to £33,296, and the expenditure (including £1,600 for debenture interest and the above-mentioned sum of £1,716) to £26,547, leaving a profit of £6,749. The directors propose to set aside for the purpose of forming a cumulative sinking fund for the redemption of outstanding debentures £500; to increase depreciation and reserve account to £13,500; to pay a dividend on the ordinary shares at the rate of 7 per cent. per annum, making 6 per cent. for the year, leaving to be carried forward £243.

Wolverhampton District Electric Tramways.—The report for 1907 states that the revenue amounted to £25,125. After deducting all expenses and debenture interest, and providing £1,000 for the renewals fund, there remains a profit of £2,622, which the directors recommend should be applied as follows: To be placed to depreciation and reserve fund, £500; to the payment of a dividend at the rate of 1½ per cent. per annum on the ordinary shares; to be carried forward, £268. An agreement has been entered into with the other companies of the Birmingham and Midland Joint Committee for providing a central car shed and repair shop at Tividale, on the basis of each company paying a rent proportionate to the number of cars owned on January 1, 1907.

Gateshead and District Tramways Company.—The report for the year ended December 31 last shows that the revenue amounted to £54,309, as against £52,622 for the previous year. After deducting all expenses chargeable to revenue and interest on mortgages, there remains a profit of £23,132, to which is added £623 brought forward, making a total available of £23,756. The directors recommend to transfer to the credit of depreciation and renewals account—which is thus increased to £15,392—£3,500; to write off depreciation of investments, £609; to sinking fund for redemption of mortgages £1,701, dividend for the year on £12,610 6 per cent. preference shares, a dividend for the year on £120,000 5 per cent. preference shares, a dividend on the ordinary shares at the rate of 7 per cent. per annum, and to carry forward £1,738.

City of Birmingham Tramways Company.—The report of the directors for 1907 states that after paying debenture interest and preference dividend there is a surplus of £35,773. Out of this an interim dividend at the rate of 5 per cent. per annum on the ordinary shares has been paid, and the directors declare a further dividend on the ordinary shares at 5 per cent. per annum, together with a bonus of 5 per cent., making 10 per cent. for the year. They also propose to transfer £27,354 to the reserve fund, thereby increasing it to £459,122, to provide for depreciation of assets, redemption of debentures, and general purposes. The traffic receipts, amounting to £146,761, show a reduction compared with last year of £131,000, due to the termination of the leases of the steam tramways in Birmingham and the sale of tramways in King's Norton and Handsworth. The expenses have been proportionately reduced.

Babcock and Wilcox, Limited.—The report for 1907 states that the net profit was £309,768, to which is added the balance brought forward, making a total of £335,664. After allowing for the interim dividends paid there remains a balance of £266,264, from which the directors recommend dividends for the half-year ending December 31, 1907, viz., 3 per cent. on the preference shares, less tax, 8 per cent. on the ordinary shares net, and a bonus of 4 per cent. net on the ordinary shares, placing £100,000 to the reserve fund and £25,000 to the dividend equalisation fund, leaving a balance of £38,664 to be carried forward. The extensions of the works referred to in last year's report have been completed and are in working order, and have enabled the increase in the business during last year to be dealt with. The volume of orders on hand at December 31, 1907, and carried over for execution in 1908 is considerable.

Dudley, Stourbridge, and District Electric Traction Company.—The report for the year ended December 31 last states that the gross receipts amounted to £46,254. After deducting all expenses, and placing £2,000 to renewals account, there remains £11,898. Deducting the dividend on the preference shares, and adding the balance of £1,050 brought forward from last account, £7,948 remains available for allocation, which the directors recommend should be applied as follows: To be placed to the sinking fund, £1,000; to depreciation and reserve, £1,000; to the payment of a dividend at the rate of 5 per cent. per annum on the ordinary shares, £5,000; to be carried forward to next account, £948. It is proposed to enter into an agreement with the Birmingham and Midland Company and the Shropshire, Worcestershire, and Staffordshire Electric Power Company to sell to the power company the generating stations at Hart's Hill, Amblecote, and Lye. As a condition of the sale of the generating stations, arrangements will be made

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for obtaining a supply of power from the Shropshire company at favourable prices.

Bruce Peebles and Company, Limited.—At a meeting of creditors of this company (in liquidation) held in London on March 27, Mr. A. W. Tait, one of the liquidators, presented the following scheme in connection with a reconstruction: That the debentures should be extended for ten years with interest as now at 5 per cent. with a sinking fund of 2 per cent.; that the trade creditors should accept 7s. 6d. in the pound in a debenture redeemable by the proceeds of the sale of securities and the collection of contract balances, which 7s. 6d. would be paid in a short time. The other 12s 6d. would be given in the shape of a cumulative 6 per cent. preference share in the new undertaking. Altogether 120,000 cumulative preference shares would be issued, of which 30,000 would be offered at par to the shareholders, and that would provide £30,000 for working capital and redeeming debentures. The creditors would take the second debentures. The meeting appointed a committee to go into the matter and report.—The Scotch creditors held a meeting in Edinburgh on March 30, when additional members were elected to the same committee.

Calcutta Tramways Company.- The accounts for the year ended December 31 last show gross traffic receipts £167,377, working expenses under all heads £104,235, and a revenue balance of £63,333. Against this have been debited debenture interest, interim and preference dividend, making a total of £48,084, leaving a balance of £15,248. The directors recommend that a final dividend at the rate of 2s. 6d. per share be paid, and that the balance of £1,777 be carried forward. In view of the heavy amount charged for maintenance during the year the directors do not propose to make any addition to the depreciation fund, which now stands at £48,080. The gross receipts are in excess of those of the previous year, which then constituted a record, by £8,521. The expenses, on the other hand, have increased by £17,317, made up of power expenses £2,024, due wholly to the fact that the plant had to be overhauled in consequence of the excessive pressure put upon it by the increased traffic, traffic expenses £1,710, maintenance and repairs £7,164, principally due to the difficulties experienced in maintaining the cars, owing to the pressure of the traffic and inadequate space for repair shops, and general expenses £6,148, mainly due to the necessarily increased amount payable for income tax and the settlement of claims of the municipality for track rent in excess of the amount agreed for the original system.

Liverpool Corporation Tramways.—The report for the year 1907 shows that the total receipts were £583,057, and after payment of working expenses there is a credit balance of £184,323. Bank interest, etc., increases this sum to £199,631. Out of this, interest on loans requires £53,059, sinking fund £54,275, repayment of loans £3,026, reserve renewal and depreciation account £55,586, and rent of leased lines £5,891. The balance of £27,793 goes in relief of rates. The number of passengers was 124,643,259, and the mileage run was 12,231,799. The increases over 1906 were: Passengers, 1,948,711, equal to 1·59 per cent.; receipts, £9,045, equal to 1·60 per cent.; and mileage, 115,865, equal to ·95 per cent. The average earnings per car-mile were 11·24d., as against 11·17d. in 1906. The traffic receipts and car-mile earnings, together with the number of passengers carried, are the highest recorded in connection with the Liverpool electric tramways. The total number of passengers carried during the week ended August 10, which included three days of the Pageant celebrations and the visit of the Channel Fleet, was 3,151,141, forming a record in the history of the undertaking for one week. The total receipts for the week amounted to £14,802 9s. 3d. The heaviest day's traffic occurred on Bank-Holiday, August 5, when 579,449 passengers were carried, and the receipts amounted to £2,797 17s. 7d.

Underground Electric Railways Company.—The directors of the Underground Electric Railways Company of London, Limited, have issued their plan for dealing with the 5 per cent. profit-sharing notes of the company which fall due on June 1 next. The board point out that when the notes were issued in 1903 it was anticipated that the work would be completed early in 1906, but unavoidable delays occurred, and the development of traffic on the electrified District Railway has been slower than was expected. Recent traffic receipts, however, had been very encouraging, and it is hoped that by 1912 the company will be earning at least its fixed charges. In the meantime, provision will be made to the extent of £300,000 to meet any deficiency in interest on bonds which the present holders are asked to accept in exchange for their notes. The exchange is to be on the basis of 40 per cent. nominal in 4½ per cent. bonds due January 1, 1933, and 70 per cent. nominal in 6 per cent. income bonds due January 1, 1948. Prior lien bonds for £1,000,000, due November 1, 1920, will be created, part of which will also be issued against payments under the interest deficiency agreement with Messrs. Speyer Brothers. The total amounts of the issues are: £1,000,000 five per cent. prior lien bonds; £3,000,000 four and a half per cent. bonds; and £5,200,000 six per cent. income bonds. The first series is underwritten by Messrs. Speyer. For the purpose of carrying out the scheme, an application was made, with the consent of all parties, in the Chancery Division on April 15, for the appointment of a temporary receiver and manager of the company. Mr. Justice Warrington appointed Sir George Gibb.

NEW CONTRACTS AND ORDERS.

Messrs. L. P. Winby and Company have received a further order from the India Office for coach-screws.

Hadfield's Steel Foundry Company have an order from Bradford Corporation for points.

Babcock and Wilcox, Limited, have an order from Burslem Town Council for a boiler at £1,500.

Edgar Allen and Company have obtained an order from Derby Town Council for tramway points.

Coventry Town Council have accepted a tender by Heenan and Froude for a refuse destructor plant at £13,769.

Pearson, Huggins and Company have an order from Gloucester Light Railways Committee for uniform clothing.

The British Thomson-Houston Company are supplying motors to Hammersmith Borough Council at £1,638.

The Tudor Accumulator Company have received an order from Beckenham District Council for a storage battery at £1,521.

Browett, Lindley, and Company have received an order for a 700 KW. generating set for the Finchley Urban District Council.

Glasgow Tramways Committee have accepted tenders from F. Smith and Company for trolley wire, and from R. and S. Baxter for mica.

Bradford Corporation, after making extensive inquiries, have decided to weld all the joints on their proposed tramway reconstruction, amounting to about six miles, by the Thermit process.

Bolton Corporation have accepted tenders by Walter Scott, Limited, for rails and fish-plates, and by Hadfield's Steel Foundry Company for tie-bars.

The British Insulated and Helsby Cables, Limited, have received an order from Barrow-in-Furness Corporation for 15 tons of copper cables at £59 10s. per ton.

Glasgow Electricity Committee have accepted a tender by Babcock and Wilcox, for five additional boilers and mechanical stokers for Port Dundas and St. Andrews' Cross stations at £12,695.

Bruce Peebles and Company have had tenders accepted by Leyton Urban District Council for a 10-H P. motor at £43 5s., and a starter and regulator at £8.

Manchester Corporation tramways have placed an order with Messrs. Edgar Allen and Company for all points, tongues, and centres required for renewals during 1908.

Messrs. Edgar Allen and Company have received an order for seventeen junctions and two complete circuses for the Tokio tramways. The work will include rails and all other parts.

Erith Urban District Council have accepted tenders for annual supplies from Callender's Cable Company for joint boxes, and from the British Insulated and Helsby Cables, Limited, for cut-outs.

Thermit, Limited, have received an order from the Bristol Tramways and Carriage Company, Limited, for welding material for making the joints in connection with the extension of their tramway system.

Hammersmith Electricity Committee have accepted tenders in connection with generating station extensions by Babcock and Wilcox, at £1,285, and by the Stirling Boiler Company, at £1,671.

The British Westinghouse Company's tender has been accepted by Liverpool Tramways and Electricity Committee for the supply of five 500-KW., and two 200-KW. motor generators.

Stockport Town Council have awarded contracts as under: E. Green and Sons, extension of economiser, £238; W. A. Shaw and Company, electrical fittings; W. B. Beattie, erecting electricity offices.

The Briton Ferry Steel Company have accepted the tender of Wellman-Seaver and Head, Limited, for a new generating station, including two steam generators, switchboard, overhead traveller and wiring.

Messrs. Geo. Robson and Company, Eclipse Engineering Works, Napier Street, Sheffield, have received an order from the Derby Corporation for one of their "Eclipse" patent portable electric track grinders.

Messrs. L. P. Winby and Company have just received repeat orders from the Derby Corporation for their "Winby" patent anchor chairs and from the Lanarkshire Tramways Company for "Winby" patent soleplates.

Dick, Kerr and Company, Limited, have an order from Belfast Harbour Commissioners for about 100 tons of steel girder tramway rails at £6 14s. per ton, with fishplates at £8 4s per ton, and bolts and nuts at £15 per ton.

Callender's Cable and Construction Company have had tenders accepted by Wolverhampton Electricity Committee for materials required up to March 31, 1911, including feeders, distributors, pilot cables, conduits, service boxes, etc.

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The Continuous Rail Joint Company of Great Britain, Limited, have received orders for continuous rail joints from Messrs. Dick, Kerr and Company, Limited, for Adelaide Municipality, and also a repeat order from the Derby Corporation.

Ilford Urban District Council have accepted the following tenders: General Electric Company, 1,000 KW. steam dynamo (Belliss engine); Babcock and Wilcox, water-tube boiler and accessories; W. T. Henley's Telegraph Works, supply of cables.

Islington Borough Council, in connection with the extensions of their electric lighting station, have accepted tenders by Babcock and Wilcox for boilers, etc., at £10,694, and by Willans and Robinson for a turbo-generator and accessories at £8,963.

Heywood Town Council have accepted the following tenders; British Insulated and Helsby Cables, Limited, cables; Whipp and Bourne, switchboard; Browett, Lindley and Company, engines and condensers: Thomas Hill and Sons, boilers.

The Lancashire Dynamo and Motor Company have received orders from Rawtenstall and Beckenham for automatic reversible boosters, and from the Electric Lighting and Traction Company, of Australia, for a booster giving 1,200 amperes at 180 volts.

Heston and Isleworth District Council have accepted tenders by W. T. Henley's Telegraph Works Company, for a year's supply of cables and disconnecting and house service boxes, and by the British Insulated and Helsby Cables, Limited, for house fuse boxes.

Bradford Corporation have accepted tenders as under: Bolckow, Vaughan and Company, 1,000 tons steel girder rails; James Russell and Sons, 55 steel poles; Clegg and Howgate, malleable iron castings; J. and T. Clark, iron castings.

Croydon Corporation have accepted tenders by Babcock and Wilcox, Limited, for a coal and ash conveyer at £1,154, by the Weber Concrete Construction Company, for coal and ash bunkers at £681 14s., and by St. Pancras Ironworks Company for switchboard flooring.

Thermit, Limited, have received an order from the Leeds City Tramways for welding material to cover the whole of their requirements during the year 1908, this being the sixth year in succession that the Leeds Corporation have made the whole of their joints by means of the Thermit process.

The Railway and General Engineering Company, Limited, of Nottingham, have sold one of their Brown and Crosta's combined rail shapers and grinders, with a covered trolley for use with this machine, to Mr. E. G. Mawbey, borough engineer and surveyor of Leicester Corporation, for use on the Corporation tramways.

Milnes, Voss, and Company, Birkenhead, had a tender for six car roof covers at £138 each recommended for acceptance by Aberdeen Tramways Committee. The Town Council, however, referred the matter back as there was a local offer at £142 10s. per car. The Committee on April 27 adhered to their recommendation.

Glasgow Tramways Committee have given the following among other orders for stores: Lorain Steel Company, special track work; British Westinghouse Company, gear wheels; Glasgow Railway Engineering Company, car axles and wheels; Brown Bayley's Steel Works, steel tyres; Miller and Company, chilled iron brake blocks and car wheels.

Colchester Corporation have accepted the following tenders for tramway supplies; Watlington and Company, overhead equipment; British Westinghouse Company, car fittings, standard pinions and armature coils; W. Wood and Company, trolley heads, sleeves, wheels, plugs, terminals and thimbles; Dick, Kerr and Company, remainder of fittings.

Huddersfield Corporation have accepted the following tenders: Cooling pond, W. H. Roy and Company; transformers, Whiteley's extension, British Thomson-Houston Company, Limited; transformers, Longroyd mill extension, British Westinghouse Electric and Manufacturing Company; switchgear, Ferranti, Limited; and plant governor, Schofield and Taylor.

H. Lotery and Company have secured contracts for uniform clothing from Liverpool tramways, Cavan and Leitrim light railway, Stalybridge tramways, Quick Cab Company, Leith tramways, Great Central Railway hotels, Sussex Motor Car Company, Whittingham Asylum, City of Westminster, Leabridge Gas Company, Nelson tramways, and Bolton Corporation.

Wallasey Urban District Council have accepted the following tenders: Chilled iron car wheels, Miller and Company; brake blocks, Wilsons, Pease and Company; axles, gears and pinions, F. W. Rowlands and Company; trolley heads, Imeson Brothers, Finch and Company; and armature, axle box and motor suspension bearings, check plates and anti-friction metal, Dick, Kerr and Company.

Wimbledon Electricity Committee recommend for acceptance a tender by Babcock and Wilcox for two boilers at £4,710, and a tender by the British Westinghouse Company for a high-tension switchboard and gallery at £2,606. For annual supplies at the electric generating station the following, among other contracts, are proposed: Conduits, Albion Clay Company; joint boxes and jointing materials, Callender's Cable Company, and W. Lucy and Company; transformers, British Westinghouse Company.

The Philipson Guard.—The Glasgow Corporation have decided, after a test extending over 12 months, to equip all their cars with Philipson's patent side lifeguards; 300 sets of the Philipson guard have been supplied to the Birmingham Corporation Tramways. The Philipson guard has now been subjected to thorough tests, and it has clearly passed beyond the experimental stage. During the trials it has achieved the record of having prevented many serious accidents.

The Mirrlees Watson Company, Limited, Glasgow, have recently received orders for a number of condensing plants, among which are the following: Hendon Paper Works, Sunderland, one surface condenser; Messrs. H. Bollinck, Brussels, one surface condensing plant; James Howden and Company, Glasgow, one surface condensing plant; the British Thomson-Houston Company, Limited, for Teesbridge Iron Works, one surface condensing plant; and W. and E. Jacob and Company, Limited, Dublin, one elevated jet condensing plant.

The British Thomson-Houston Company have received an order from the Tyneside Electrical Development Company for an exhaust steam turbine having an output of 1,500 K.V.A., at 2,875 volts, 40 cycles, when running at a speed of 2,400 revolutions per minute. The turbine will be of the standard Curtis type, containing two stages, direct-coupled to a three-phase, 40-cycle alternator. The steam for this turbine will be supplied from the works of the Teesbridge Iron Company at atmospheric pressure, and will be condensed by a surface condensing plant of Messrs. Mirrlees Watson Company. The condensed steam will be returned to the Teesbridge Company. Provision has been made so that should the turbine not be running at any time it can be isolated from the condensing plant, and the condensed steam still utilised for the boiler feed for the Teesbridge Iron Company. The turbine and the generator will be capable of an overload of 1,800 K.V.A. The plant has been so arranged that the necessity for the usual foundations are avoided, the condenser being on the same floor level as the turbine itself. The air and circulating pumps will be driven by three-phase, 440 volt, 40-cycle B.T.-H. motors. The sluice valve between condensing plant and turbine will also be motor-operated.

Salford Annual Supplies.—Salford Town Council have fixed contracts for annual supplies as follow: United Electric Car Company, twenty tramcar bodies; Hurst, Nelson, and Company, four tramcar bodies; Mountain and Gibson, trucks for car bodies; British Westinghouse Company, electrical equipments for tramcars; Watlington and Company, overhead insulating materials; Docker Brothers and Nobles and Hoare, special paints and varnishes; Tramways Supplies (Limited), G. Hill, and T. Noakes and Son, overhead insulating materials; W. McGeoch and Company, J. Hall, L. Andrew and Company, Siemens Brothers' Dynamo Works, F. Reddaway and Company, British Thomson-Houston Company, General Electric Company, Baxendale and Company, Ward and Goldstone, Boydell and Sons, and British Westinghouse Company, electrical car accessories; British Westinghouse Company, and Malleable Steel Castings Company, special car accessories; Malleable Steel Castings Company, Player and Mitchell, R. and H. F. Phillips, J. H. Sharrock, J. Hall, R. Johnson, Clapham and Morris, Brecknell, Munro, and Rogers, Watlington and Company, J. Cookson (Limited), J. Baker and Company, British Westinghouse Company, W. Boydell and Sons, Tandem Smelting Syndicate, and Estler Brothers, mechanical car accessories; Watlington and Company, R. Johnson, Clapham and Morris, Brecknell, Munro, and Rogers, and G. R. Feather and Company, ears, frogs, pull-offs, etc.

London County Council have accepted tenders as under: Permanent way construction, excluding rails and special track work, of Brixton to Camberwell tramways, 2½ miles single track, for overhead wire system, Mr. W. Manders, Leyton, £17,091; paving works for street widenings for same lines, Mr. W. Manders, £2,185; high-tension cables for various lines, British Insulated and Helsby Cables, Limited, £32,000; low-tension cables and telephone cables for various lines, W. T. Henley's Telegraph Works Company, £36,101; steam, exhaust and other piping, etc., for second portion of Greenwich power-station, John Spencer, Limited, £10,910; Walter Scott, Limited, extension of existing rail contract so as to include 475 tons of track rails and fastenings for Queen's Road, Battersea, tramways, at about £3,632; F. W. Rowlands and Company, 20,000 brake-wearing shoes, £937; Forced Lubrication Company, shafting, brackets, pulleys, etc., for central car repair depot, £500 3s. 2d.; H. W. Ward and Company, accessories for a 7½ in. capstan lathe at the car repair depot, £103 14s. 9d.; Hadfield's Steel Foundry Company, special track work for renewal of junctions, £4,524 10s.; Hurst, Nelson, and Company, car furniture for 50 cars, £369 0s. 9d. a set; United Electric Car Company, 50 sets of brake gear, £4 19s. a set; Hurst, Nelson, and Company, 50 sets of sanding gear, movable steps, and lifeguards, £8 2s. 6d., £3 12s. 6d., and £4 5s. a set respectively; Hurst, Nelson, and Company, 50 sets of window operating gear, £12 10s. a set; Hoskins and Sewell, 50 sets of ventilator operating gear, £3 a set; Hurst, Nelson, and Company, 418 sun-blinds, £292 10s.

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PERSONAL.

Mr. E. S. Rayner, electrical engineer to Doncaster Corporation, has been granted an increase in salary to £400 per annum.

Mr. T. W. Bloxham has been granted an increase of salary by the Belfast Town Council.

Mr. H. G. Thompson, Swansea, has been appointed electrical engineer at Neath.

Mr. A. Dimmack, borough electrical engineer, Swindon, has had his salary raised from £200 to £250 per annum.

Mr. W. H. Cooke, borough electrical engineer of Luton, has been granted an honorarium of £100 in recognition of his services in connection with the construction of the new tramways.

Mr. Cameron, hitherto assistant electrical engineer to Northampton Corporation, has been appointed chief engineer in succession to Mr. J. McMahon. The salary is £150 rising to £180.

Mr. J. A. Sykes, deputy engineer and manager at Heston and Isleworth electric light station, has been appointed head of the electrical department of a shipbuilding and steel works in Scotland.

Mr. Charles Burgess, assistant traffic superintendent of Kirkcaldy tramways, has been recommended by Wigan Tramways Committee for the post of traffic manager in Wigan. There were 113 applicants, and the salary is £200 per annum.

Mr. P. J. Robinson, hitherto mains engineer in connection with Liverpool Corporation tramways, at a salary of £300 per annum, has been appointed superintending engineer of stations at £350, increasing in twelve months to £400 per annum.

Mr. Donald McColl, of the Metropolitan District Railway, and formerly with the Glasgow Corporation and the Lisbon Electric Tramways, has been appointed general manager of the Shanghai Electric Construction Company's tramways in Shanghai.

The French Government has conferred on Mr. Robert James Wylie, of the Paris Tramway Company, the Cross of a Chevalier du Merite Agricole. Mr. Wylie was for twelve years traffic manager of the London Tramways Company before going to Paris in 1891.

Mr. Woof, who has superintended for Messrs. Dick, Kerr and Company the work of overhauling the generating plant at the electricity station of Sydney (N.S.W.) City Council, has been appointed by the Council power-house superintendent at a salary of £400, rising to £500 per annum.

Councillor Barrow has been appointed chairman of Birmingham Tramways Committee, in place of Alderman Beale, who has been elected chairman of the Water Committee. The Tramways Committee expressed regret at losing Mr. Beale's services, and awarded him a hearty vote of thanks.

Mr. J. McMahon, electrical engineer for Nottingham Corporation tramways, who was recently appointed electrical engineer and manager for the Dumbarton tramways, has been presented by the Nottingham tramway staff with a revolving dish and tray and a gold albert chain and medallion.

Institution of Civil Engineers.—At the annual general meeting held on Tuesday, April 28, Mr. James Charles Inglis, general manager of the Great Western Railway, was elected president, and Messrs. W. R. Galbraith, G. H. Hill, Alexander Siemens, and W. C. Unwin were elected vice-presidents.

Mr. T. Partington, of the Blackpool, St. Annes, and Lytham Tramways Company, Limited, has been appointed car shed foreman of the Falkirk and District Tramways Company, and on leaving Blackpool, he was presented with a handsome case of drawing instruments by the manager and staff.

Carlisle Officials.—Mr. C. D. Burnet, city electrical engineer, Carlisle, has been presented by the works' staff and friends with a gold-mounted cigar case and a walking stick. Mr. G. S. Scurfield, who has retired from the position of deputy city electrical engineer at Carlisle, has been presented by the staff and friends with a non-magnetic recording chronograph.

Mr. Morton Beales is severing his connection with Messrs. Bruce Peebles and Company, Limited, and is entering into partnership with Mr. M. M. Gillespie. The new firm will be styled Gillespie and Beales, and will have offices at Amberley House, Norfolk Street, Strand, W.C., where they will carry on business as buying and selling engineers, exporters and contractors.

Glasgow Salaries.—The Tramways Committee of Glasgow Corporation recommend that the salary of Mr. James Dalrymple, general manager, be increased by £100. Mr. Dalrymple has been twenty-seven years in the service of the Corporation, and joined the tramways department in 1894. He was appointed general manager in 1904 at a salary of £1,000, and has received no increase since his appointment. It is also recommended that the salaries of each of the following officials be increased by £25: Mr. L. Mackinnon, traffic superintendent, entered the service in 1892, present salary £575; Mr. J. Ferguson, chief engineer, entered the service in 1897, present salary £575; and Mr. J. N. Wilson, secretary and treasurer, entered the service in 1894, present salary £325; and that the salary of Mr. E. T. Goslin, electrical engineer, who entered the service in 1900, and whose present salary is £475, be increased by £75.

Mr. J. T. Cornish, M.I.E.E., chief engineer of the La Capital Traction and Electric Company, Metropolitano Tramway, Grand National Tramway Company, Buenos Aires Electric Tramway Company, Belga Argentina Tramway Company, and consulting engineer of the Cordoba Light and Power Company, has been appointed resident engineer of the City of Santos Improvements Company (gas, water, electric lighting, and tramway), Brazil, and left to take up his duties on May 1. The conversion to electric traction of the Grand National Company's system, some 100 miles of single track, was carried out under his supervision. This will not be Mr. Cornish's first visit to Brazil, as he went to the State of Sao Paulo in 1891, and remained some years in connection with electric light construction. He was subsequently engaged in the construction of the first electric tramway system in Buenos Aires some eleven years ago.

Sheffield Corporation Officials.—A re-arrangement of duties of the officials of the Highways and Sewage Committee of the Sheffield Corporation has taken place. Mr. C. F. Wike, M.I.C.E., who has been city surveyor for eighteen years, has been appointed city surveyor and engineer, and Mr. W. H. Hadfield, who has been deputy city surveyor, has been appointed surveyor of highways, and made responsible to the Tramways Committee for the maintenance of the tramway track. It has also been decided to appoint a city architect to undertake the whole of the architectural work required to be done by any of the Committees of the Corporation, the salary for this position to be £650 per annum. This official and his staff are to be under the control of the Establishment Committee, and all officers engaged on architectural work in the several departments of the Corporation are to be transferred to the city architect's department.

Mr. W. J. Newton, borough engineer of Accrington, has been granted an increase of salary by the Town Council. The proposal was put forward by the General Purposes Committee that the salary should be raised from £420 to £470 per annum in view of his long and arduous services in carrying out the conversion of the tramways, and of the additional duties and responsibility involved in the supervision of the new sections of tramways. The Mayor explained to the Council that Mr. Newton had been up early and late supervising the work, when he was not required to do so under his agreement with the Corporation. Moreover, Mr. Newton had done the work uncommonly well, and if the Corporation had had to pay an outside engineer on the usual five per cent. basis for supervision it would have cost £1,500. There was very solid ground for making a grant to the borough engineer. Since the resolution was passed, however, Mr. Newton had expressed a wish to have a portion of the money in a lump sum, so the committee met before the council meeting, and decided to give him a smaller advance in salary, and to commute the difference by a sum of £300 down for his immediate personal use. Mr. Newton had pointed out that in case of his decease or retirement the original arrangement would deprive him of the remuneration for his extra services already given. After some discussion, the proposal as modified by the Mayor's statement, was agreed to.

Sir Charles Petrie, chairman of Liverpool Tramways Committee, was, on April 14, presented by the members of the Tramways Social, Athletic, and Thrift Society with an oil painting by Mr. Hamilton Hay, representing a night tramway scene at Liverpool Pierhead. Alderman Lloyd, introducing the representatives of the society, said they were desirous to express the esteem in which Sir Charles was held as the head of the tramway service in Liverpool, and especially for the efforts he had made for the well-being and amelioration of the status of the tramway men. The time had come, he thought, when some tangible expression should be given of the men's feelings of good-will towards Sir Charles, and there had been secured for this purpose a picture by a rising Liverpool artist, which vividly depicted the transformation which had taken place at the Pierhead—formerly always a dull locality—since the establishment of the tram service. Complimentary speeches in reference to Sir Charles Petrie's work, were also delivered by Mr. H. P. Reynolds, Alderman F. Smith, Mr. Skelton, Mr. Mallins (traffic manager), and Mr. John Flynn (a driver). Thereafter Inspector W. Coffey formally made the presentation. Sir Charles Petrie, in replying, said while he was deeply grateful, he felt that he had not done anything more than his duty in connection with the position he occupied. Deeply interested in the welfare of the men as he was, he had done no more than other members of the committee. They had all been of great assistance to him, and he was glad that their work had been recognised. It had always been his wish to make the lot of the tramwaymen as happy as it could be; and it was highly gratifying to have in their service such an excellent lot of men. By treating the men in a proper manner, and with good fellowship between the Committee and the members of the City Council, the tramways would always be a credit to the city of Liverpool.

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TRAMWAY AND LIGHT RAILWAY NOTES.

ABERDEEN.—An example of the peculiar financial arrangements as between the Aberdeen tramway and electricity departments is to be found in the business transacted by a meeting of a sub-committee of Aberdeen Corporation on April 15. The meeting was held for the purpose of readjusting the amount to be paid by the tramway department to the electricity department for services rendered by the electrical engineer. In view of the fact that the repairing of the cars is now carried out under the supervision of the manager of the tramways, it was agreed that the Tramway Committee pay the Electricity Committee £70, instead of £140 as formerly.

BIRMINGHAM. — Handsworth Urban District Council have confirmed a recommendation by the Tramways Committee in favour of the Council purchasing the part of the Birmingham cable tramway which is in Handsworth, and of getting the Board of Trade to appoint a referee to settle the price to be paid to the Birmingham Tramways Company. It was stated that an additional dynamo would be needed in the Council's electricity station to provide current for the line after it was electrified.--At a meeting of Handsworth Urban District Council on April 15, Mr. John Edwards, chairman of the Tramways Committee, stated that the committee had had a meeting with representatives of Aston and of the Birmingham Tramways Company, when the company consented to through running of cars from Birmingham to Perry Barr on the following conditions: Birmingham City Tramways Committee to receive a penny, and the British Electric Traction Company, who have powers over the Aston portion of the line, and the Handsworth District Council to receive 1½d. between them in equal shares, the fare to be 2½d. As a condition to this arrangement the Council to purchase the Villa Road line for a sum of about £1,850, the purchase to be completed and the District Council to electrify the Villa Road line up to Soho Road. The British Electric Traction Company undertook to run cars through up to Soho Road, and to make a new penny stage from Six Ways, Aston, up to the end of Villa Road; Handsworth to receive in respect of this ·34 of a penny, and the British Electric Traction Company ·66d. Councillor Edwards, continuing, said, as far as they were concerned they had either to accept those terms or refuse them. It was the final offer of the British Electric Traction Company, and the committee, who had given a great deal of time and consideration to the matter, recommended their acceptance. The Council adopted the proposal by 13 votes to 5.

BRIERLEY HILL.—At a meeting of Brierley Hill District Council an agreement was approved between the Joint Tramway Committee of Brierley Hill, Quarry Bank, and Rowley Regis District Councils and Mr. C. S. Vesey Brown, representing a proposed company, for the taking over of the Councils' Light Railway Order. A statement made by Mr. T. Williams, in moving approval of the agreement, explains the position of matters. He said that the Order was granted to the three Councils in 1903, and from that time to the present the Joint Committee had been looking round with a view to disposing of the Order. After many negotiations with different individuals they had the result embodied in the present agreement. The Councils were, by the terms of the agreement, bound to lay down the permanent way, and when this was done the company would take this over and do the other necessary work, the equipment part of the undertaking and the working of the line. With regard to the financial aspect, the proposed company would have to pay the Council's 5½ per cent. on the outlay.

DERBY.—The Town Council have, by a majority, decided to proceed as soon as possible with the construction of an authorised tramway extension in Burton Road to the borough boundary, a distance of 800 yards, at a cost of £5,500.

DUNDEE.—At a meeting of Dundee Tramways Committee on April 20, Mr. Peter Fisher, the manager, reported on a proposed circular tramway route from Arbroath Road to Strathmartine Road. The length would be 2½ miles, and the cost of construction of double track would be £28,500. A fair estimate of the earnings was £2,738 per annum, while the cost of working, maintenance, etc., would be £7,690, showing a deficit of £4,952 per annum. An alternative route would be 1½ miles long, and single track with passing places would cost £10,900. The annual revenue would be about £1,870, and working expenses, maintenance, etc., would come to £4,019, showing a loss of £2,149 per annum. The Committee had also before them a report from Mr. Fisher in regard to the running of motor 'buses between the Maryfield and Fairmuir termini on the trackless trolley system. Mr. Fisher said the Board of Trade had stated it was within their power to grant the necessary permission to erect and work such a system, provided the details were satisfactory. Unfortunately, there was no centre in Britain where such a system was in operation, but the system was in existence at places on the Continent, and Mr. Fisher, in giving details of such systems, stated the operating cost, including maintenance of the cars and motors, and of the line and power plant, was something under 5d. per car mile. If it were possible to run the cars at anything like that figure the service could be profitably worked in sparsely-populated districts. The Committee deferred consideration till further information had been obtained.

EAST HAM.—The Town Council have decided to purchase from the North Metropolitan Tramways Company the piece of horse line between Green Street and Manor Park Broadway, at a cost of £8,000. The tramway forms a link in the chain of lines leading all the way from London to Ilford, and if it is now reconstructed for electric traction, it will be possible to run through cars over the entire distance. The Town Council of East Ham already own some seven miles of electric routes.

EDINBURGH.—The directors of the Edinburgh and District Tramways Company have approved of a scheme of the manager, Mr. C. W. Shepherd, for the service of cars to and from the Scottish National Exhibition at Gorgie, which is in the south-western outskirts of Edinburgh. There are two tramway routes to the Exhibition, one terminating at Gorgie and the other at Murrayfield. The Gorgie route takes the cars right to one of the Exhibition entrances; but the other stops about three-quarters of a mile from the main entrance. In this connection surprise has been occasioned by the refusal of the Tramways and Streets and Buildings Committees of the Town Council to accept the offer of the Cope Syndicate to lay down free of cost an electric tram line on their shallow conduit system from the Murrayfield terminus to the Exhibition main entrance. The time-table, which has been drawn up by Mr. Shepherd, shows that there will be a service of no fewer than 90 cars per hour from the city to the Exhibition.—Major Pringle, on behalf of the Board of Trade, inspected the new Gilmore Place cable tramway in Edinburgh on April 14, and later in the day the line was opened for traffic. He also examined a siding at Gorgie, which has been constructed near the gates of the Scottish National Exhibition. It is capable of accommodating a large number of cars, which can be massed there for the purpose of rapidly taking away crowds of people at the time of closing the Exhibition each evening. The siding can also be used for setting down passengers on arrival.—Representatives of Edinburgh and Leith Town Councils have been struggling for two or three months to come to an agreement as to the construction of a proposed tramway from Leith to Granton, part of which would be in Edinburgh and part in Leith. The details of the difficulties and of the settlement which was arrived at on April 10 are of little general interest, except that Edinburgh will not be able to become sole owner of the part of the tramway within its bounds, an arrangement for joint ownership (in event of purchase) of the whole line being arrived at.

FALKIRK.—At a meeting of Falkirk Town Council on April 20 a letter was read from the secretary of the Falkirk and District Tramways Company, setting forth the proposals of the company relative to the proposed extension of the system to Laurieston. Unfortunately, the tramways had not been a financial success, owng to the heavy way-leaves and operating charges for bridges, and the shareholders were unwilling to put up further capital unless upon such terms as would show a reasonable profit. The secretary stated seven conditions upon which the company might be prepared to proceed with the extension now, the chief of these being that the Council would relieve them of charges for way-leaves; that the Council would bear the cost of paving the sections between the rails in High Street; and that the Council would maintain these sections other than the rails. Provost Christie moved that the Council write declining to agree to the terms of the letter. The motion was agreed to.

GLASGOW.—In Glasgow Sheriff Court, Sheriff Mackenzie has given judgment in an action for damages by Mr. John Geddes, contractor, against Glasgow Corporation. It appeared that while the pursuer was a passenger in one of the Corporation's tramway cars, the conductor from whom he received his ticket was relieved by another conductor. Subsequently the second conductor asked the pursuer to show his ticket, and Mr. Geddes did so. As the number did not correspond with that of any ticket issued by him the conductor left to consult the slip given to him by the conductor he had relieved, and, having done so, he returned, and again asked Geddes to show his ticket. Geddes refused to show it or to pay the fare from the starting point of the car, offering his card, which the conductor refused to take. He was detained on the car, and escorted to the police office. The Sheriff found that in detaining Geddes until his name and address were ascertained the Corporation's servants were acting within the scope of their employment, but that his detention after he had offered his card was wrongful and illegal. The Sheriff, therefore, awarded Geddes £5 in respect of the injury to his feelings caused through the action of the conductor.

GLOUCESTER.—The Town Council have, against the advice of the tramway manager, resolved that motormen should be selected from those conductors who are trained and qualified for the work, unless sufficiently good reason exists to justify the appointment of other persons in preference to conductors.—The system of penny transfer tickets which is now in operation in Cardiff has also been adopted in Gloucester, so that a passenger may for a penny travel half-a-mile on one route, transfer to another car and travel another half-a-mile by it. Along with this change single halfpenny tickets have been abolished.

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LANCASTER.—At a meeting of Lancaster Town Council on April 22, the Tramways Committee recommended that there should be a halfpenny fare between Castle Station and the Market, and a universal fare of a penny between the Market and any other point. This was met by an amendment in favour of reversion to halfpenny stages and no overlapping stages. The amendment was carried by 17 votes against 8.

LONDON.—On April 4 the newly-electrified line of the London County Council from Brixton *via* Stockwell Road and South Lambeth Road was opened for traffic, thus enabling cars to run between Brixton and Victoria Station. On the same day electric cars began running from Greenwich to Lewisham. On April 10 the southern part of the tramway subway from Victoria Embankment to Aldwych was opened, and through cars now run between North and South London. The line was described in our issue of April 2.

NEWCASTLE.—At a meeting of Newcastle Tramways Committee on April 9, Mr. E. Hatton, the general manager, said that the accumulator cells at the City Road power-station required re-lining and renewing, and he estimated the cost of doing what was necessary at £4,000. It was agreed that tenders be obtained for carrying out this work, the cost to be provided out of the renewals fund, which at the present time stands at £47,000, to which there is still to be added the profits of last year. Mr. Hatton also reported that it was absolutely necessary to provide two new pumps for the pumping station on the Quayside to deal with the water for condensing at the power-station. It would also be necessary to lay in a new suction pipe from the power-station to the river frontage. The estimated cost would be about £4,800. It was also agreed that tenders should be obtained. The expenses of these will also be charged to the renewal fund.

NEWPORT.—The latest instance of awakening to the necessity for strengthening the tramway renewal reserve fund comes from Newport, where the Electricity and Tramways Committee of the Corporation have resolved to recommend that before any surplus from the tramways is applied to the relief of rates, a sum averaging £3,000 per annum should be paid into the tramway reserve fund.

NOTTINGHAM.—At a meeting of Nottingham Town Council on April 6, a report was submitted by the General Purposes Committee containing the text of a proposed agreement with the Nottinghamshire and Derbyshire Tramways Development Company with regard to the construction and working of certain tramways in the city, and the transfer to the Corporation of certain of the company's powers. The agreement provides that the Corporation shall support a Parliamentary Bill promoted by the company for a further extension of time, and for a grant of running powers over certain of the tramways of the Corporation, in return for which the company will transfer to the Corporation existing powers to construct tramways from Carlton, Arnold, and Beeston to junctions with the Corporation's tramways. The company are also to try to get statutory powers for the construction by the Corporation of a connecting tramway from Basford. This line and a part of another are to be leased to the company for 42 years. The Council approved the proposals.

OXFORD.—The tramways have been taken over from the old company by the National Electric Construction Company on terms mutually arranged.

ROCHESTER.—After being inspected by Major Pringle, of the Board of Trade, the tramways constructed by Rochester Town Council were opened for traffic on April 16. The lines are worked on lease by the Chatham and District Light Railway Company in conjunction with the tramways in Chatham and Gillingham.

SOUTHPORT.—A new departure has been made by Southport Tramways Committee, in that they have decided to issue contract tickets for the carriage of dogs on the cars, at 5s. per quarter. The committee have resolved to pay 1s. per man to drivers for each week in which the average consumption of electric energy per car mile is reduced by one-tenth of a unit below the average consumption for the year ended March 31 last. During that year the consumption was 1·16 units per car mile.

TORQUAY.—The new Torbay Road section of the Torquay tramways, nearly a mile in length, and the last section of the eight and a half miles of tramways now running through the borough, was opened for public traffic on April 16, when the Mayor (Mr. W. R. V. Webb) drove the first car, which was decorated with flags and evergreens, his Worship carrying out the duties of motorman for the whole distance. He was accompanied by members and officers of the Corporation and the leading tramway officials.

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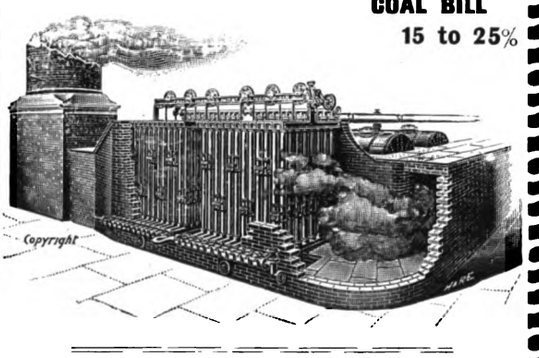

Patentees and Sole Makers—

E. GREEN & SON, LD., Wakefield, Manchester, London, and Glasgow.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

∴ If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS.

Applications for Letters Patent have been filed :

6,384 Run-back automatic electric brake—E. Daley and R. Roberts.
6,432 Electrical alarms for tramcars—T. R. Kinsella and C. W. Hodgetts.
6,455 Car ventilators—T. H. Garland.
6,479 Silent stopping signal for tramcars—G. Masters.
6,721 Tramway points—E. Veevers and G. H. Butterworth.
6,749 Rail joints—J. Sevcik.
6,750 Combination for conveying lubricants to the journals of electric motors, and railway and tramway axles—C. H. Stone and E. S. Quilliam.
7,111 Device for preventing collision of trams—E. Schnyder
7,231 Tramway trucks—The Brush Electrical Engineering Company, Limited, and R. L. Acland.
7,357 Heating of motor omnibuses—L. W. Williams and M. W. Davidson.
7,391 Motor omnibus bodies—A. De Dion and G. Bouton.
7,424 Tramway car fenders—P. Bickart.
7,434 Electric traction systems—The British Thomson-Houston Company *(The General Electric Company)*.
7,460 Automatic tram signal—P. L. Naish.
7,511 Railway or tramway locomotive vehicles—C. Robinson.
7,513 Railway and tramway wheels—W. H. Kitson.
7,589 Controlling motors of power-driven vehicles—J. E. Francis.
7,631 Railway or tramway vehicle—C. A. Carus-Wilson.
7,670 Safety cut-outs for overhead wires of traction systems—A. E. Dixon.
7,750 Electric locomotives—E. C. Ketchum.
7,792 Sand-distributing apparatus for tramcars, railway trains, and motor vehicles—M. J. Sexton and J. J. Sexton.
7,941 Electric brakes—P. S. Turner.
7,944 Automatic frog for overhead trolleys—W. Gray.
7,958 The preventing of the raising of dust by motor omnibus wheels—W. Page.
8,144 Operation of street railway switches—L. Z. Preston.
8,232 Point-shifting mechanism for tramways and railways—J. Lynn.
8,255 Brake-operating mechanism for tramway cars—A. Dickinson.
8,357 Electric device for preventing collision of railway trains—C. Lagden and A. Catchpole.
8,363 Automatic non-skid appliance for motor omnibuses—A. Tomlins and R. Burstinghaus.
8,384 Tramcar fenders—O. Sturm.

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8,445 Tramcar lifeguards—J. Bowring.
8,462 Side lifeguards for tramway cars—B. K. Noy.
8,467 Braking gear for overhead electric cranes—A. Jack.
8,553 Railway and tramway improvements—G. W. Green.
8,606 Pneumatic track sanders—H. Rau, junr.
8,675 Car couplers—C. H. Tomlins.
8,869 Vehicles for tramways and railways—Mountain and Gibson, Limited, and A. F. H. Head.
8,870 Tramway and railway vehicles—Mountain and Gibson, Limited, and A. F. H. Head.
8,934 Electric block system for railways and tramways—W. H. Edridge, and F. Justinien, and S. C. Pradel.
8,947 Anti-skidding device for motor omnibuses—A. Tomlins and A. Wilson.
8,968 Installation for electrically controlling railway points—Siemens Brothers and Company, Limited *(Siemens and Halske, Akt.-Ges.)*
9,050 Fish joint for railway rails—J. Baka-Abakowsky.

Specifications Published.

1906.

29,645 Power-driven vehicles—Simpson and Park.

1907.

2,588 Dynamo-electric transmission gear for motors—Albrecht.
5,300 Point arrangements of the side slot conduit system of electric traction—Garrod.
5,402 Electric traction on the surface-contact system—Suchostawer.
5,671 Control of electrically-propelled vehicles—The British Thomson-Houston Company, and Hopps.
5,749 Cable for electric traction on the stud-contact system—Griffiths and Bedell.
6,992 Electric railway signalling apparatus—Notarianni.
15,665 Non-skid attachment for motor omnibuses—Klapka and Dunn.
17,539 Elevated electric railways—Gilstrap.
17,832 Trolley wheels for electric traction—Sawyer.
18,272 Brake mechanism for car trucks—Adams.
21,982 Trolley heads or collectors of electricity—Drewet.
24,770 Insulated rail joints—Wolhaupter.
6,064 Bow trolleys or collectors for electric railways and tramways—Brecknell, Munro and Rogers, Limited, and Munro.
15,636 Automatically-operated station indicators for electric railways—Daley and Daley.
28,202 Railway rail joints—Steele.
11,523 Tramway conduit points—Kneen and King.
19,880 Car wheels—Robertson.
8,860 Driving-wheels for electrically-propelled vehicles—Balachowsky and Caire.
9,270 Automatic electro-magnetic and foot sanding gear for electric tramways and railways—Cummins.
12,605 Safety reflectors for tramcars—McLean and Gibson.
18,534 Manufacture of track rail sand—Taylor.
10,991 Signalling device for tramways and railways—Dewhurst
25,832 Insulated railway rail joint—Wolhaupter.
25,833 Insulated railway rail joint—Wolhaupter.

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TRAFFIC RETURNS.

TRAMWAYS AND OMNIBUSES.	1907. WEEKS ENDING.					1908. WEEKS ENDING.					AGGREGATE.		
	Mar. 30.	Apl. 6.	Apl. 13.	Apl. 20.	April 27.	Mar. 28.	Apl. 4.	Apl. 11.	Apl. 18.	Apl. 25.	Wks.	1908.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	1,178	1,359	1,250	1,209	1,156	1,187	1,251	1,223	1,214	1,251	47	63,460	- 1,266
Ayr Corporation	209	321	237	223	213	181	207	211	246	319	49	14,066	- 19
Bath Electric	645	730	1,291	719	720	577	620	652	643	1,001	16	9,705	- 1,082
Belfast City	3,626	4,683	3,272	3,329	3,496	3,352	3,507	3,554	3,585	4,356	4	13,069	- 478
Birmingham Corporation	5,595	6,536	5,275	5,241	5,642	6,273	6,364	6,295	6,183	6,816	4	23,197	+ 1,156
Blackburn Corporation	964	1,989	985	961	972	972	1,043	1,030	997	1,891	4	4,962	+ 59
Blackpool and Fleetwood	639	1,032	280	297	288	245	279	261	610	883	17	4,635	+ 197
Blackpool Corporation	500	1,633	1,662	453	448	358	313	584	520	2,235	3	3,339	+ 771
Bolton Corporation	3,276	2,243	2,036	2,010	2,068	2,210	2,240	2,244	3,010	2,299	4	9,202	+ 845
Bournemouth Corporation ...	1,455	1,195	1,622	1,496	1,589	1,396	1,235	1,489	1,483	2,533	3	5,746	- 323
Bradford Corporation	4,836	6,294	3,884	4,204	4,310	4,237	4,310	4,279	4,616	5,591	4	17,199	- 864
Brighton Corporation	1,078	1,057	795	739	798	703	716	756	910	899	4	3,070	+ 162
Bristol	5,257	6,818	4,701	4,781	4,682	4,422	4,538	4,583	4,778	5,899	17	78,420	- 2,401
British Elec. Trac. Co's. Undertakings													
Airdrie	223	239	226	224	213	223	214	214	217	230	16	3,602	+ 70
Barnsley	168	225	218	149	157	165	177	178	190	232	16	2,764	+ 213
Barrow	275	303	203	213	217	223	225	218	284	273	16	3,608	+ 65
Birmingham and Mid. Joint Com.:													
Birmingham and Midland ...	770	1,193	704	706	...	775	809	795	791	...	15	11,952	+ 486
City of Birmingham	2,836	3,434	2,672	2,541	2,557	2,663	2,733	2,746	2,710	2,969	16	43,827	+ 546
Dudley-Stourbridge	870	1,407	757	752	762	727	792	751	763	1,094	16	12,148	- 902
South Staffordshire	916	1,435	821	823	837	839	885	848	841	1,094	16	14,025	- 87
Wolverhampton District ...	455	739	415	405	415	410	449	425	413	615	16	7,119	- 62
Cavehill	83	300	62	65	67	59	54	74	88	294	16	1,215	+ 76
Devonport	519	565	420	431	419	395	431	447	519	479	16	6,921	- 114
Gateshead	1,072	1,138	920	940	949	982	1,003	973	1,047	1,064	16	16,099	+ 406
Gravesend and Northfleet ...	256	368	210	222	223	188	201	189	205	232	16	3,088	- 473
Greenock-Port Glasgow	673	784	726	631	639	462	469	508	536	598	16	7,775	- 2,097
Hartlepool	311	354	236	262	251	181	194	198	218	234	16	3,449	- 623
Jarrow	163	185	105	114	118	94	95	94	114	120	16	1,596	- 176
Kidderminster	104	211	93	92	92	86	87	86	91	151	16	1,430	- 119
Leamington	143	246	159	126	131	121	125	174	137	225	16	2,225	+ 22
Merthyr...	235	316	196	187	185	190	199	214	222	305	16	3,291	+ 49

(Continued on page 376)

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TRAFFIC RETURNS—*continued.*

TRAMWAYS AND OMNIBUSES.	1907. WEEKS ENDING.					1908. WEEKS ENDING.					AGGREGATE.		
	Mar. 30.	Apl. 6.	Apl. 13.	Apl. 20.	Apl. 27.	Mar. 28.	Apl. 4.	Apl. 11.	Apl. 18.	Apl. 25.	Wks.	1908.	Increase or Decrease.
British Elec. Trac. Cos.—*continued.*	£	£	£	£	£	£	£	£	£	£		£	£
Metropolitan Electric	5,168	6,293	3,813	4,152	3,954	4,807	5,179	5,016	6,033	5,927	16	79,664	+ 14,915
Middleton	431	648	292	300	299	312	333	319	429	485	16	5,233	+ 91
Oldham-Ashton	716	872	524	553	561	575	598	562	724	745	16	9,430	+ 64
Peterborough	155	225	110	102	103	107	110	109	132	148	16	1,749	- 27
Potteries	1,813	2,029	1,629	1,708	1,769	1,831	1,850	1,671	1,751	1,915	16	29,704	+ 724
Rothesay	81	358	196	128	102	48	50	73	148	347	16	1,206	- 156
Sheerness	47	80	51	53	49	44	47	50	49	67	16	788	- 10
South Metropolitan	962	1,206	603	673	690	661	718	678	821	862	16	10,940	- 352
Southport	305	516	246	233	242	207	225	226	265	398	16	3,492	- 330
Swansea...	888	1,095	780	795	770	874	870	950	935	1,061	16	13,925	+ 1,018
Taunton	42	62	43	39	39	38	42	37	43	53	16	621	- 18
Tynemouth	239	347	172	161	172	141	146	144	200	218	16	2,410	- 286
Weston-super-Mare	33	222	65	55	63	24	27	35	36	184	16	573	- 137
Worcester	288	498	245	237	249	232	239	256	269	318	16	3,894	- 52
Wrexham and District	128	131	108	112	91	81	93	116	156	114	16	1,547	- 7
Yorks. (Woollen) District ...	947	1,374	878	877	927	854	935	867	916	1,198	16	14,299	- 519
Burnley Corporation	1,718	1,335	1,118	1,154	1,158	1,160	1,324	1,177	1,642	1,195	17	25,845	+ 388
Burton-on-Trent Corporation ...	303	315	262	254	260	242	260	244	268	262	4	964	- 4
Bury Corporation...	...	897	928	1,601	931	...	834	1,085	1,547	1,115	3½	4,584	+ 778
Cardiff Corporation	2,090	2,450	1,905	1,907	1,871	1,959	2,012	2,003	2,045	...	3	5,333	- 787
Carlisle, City of	169	200	161	162	160	171	163	156	178	178	17	2,590	+ 62
Chatham and District	686	1,158	666	640	638	585	647	641	660	1,081	16	10,326	- 423
Chesterfield Corporation	212	173	340	184	192	208	169	263	210	286	3	759	+ 145
Colne and Trawden	366	251	178	187	199	186	187	194	314	202	17	3,207	- 99
Cork Electric	471	508	444	444	462	388	392	439	445	468	16	6,456	- 468
Croydon Corporation	1,569	2,176	1,247	1,291	1,312	1,259	1,325	1,269	1,437	1,464	4	4,703	- 534
Darlington Corporation	205	252	182	173	191	188	194	183	183	214	4	784	- 25
Derby Corporation	874	971	669	701	701	776	796	830	922	910	3½	3,186	+ 235
Dover Corporation	254	276	195	189	191	153	117	162	202	212	4	694	- 158
Dublin and Lucan	118	166	102	100	112	96	99	108	128	176	17	1,681	+ 44
Dublin United	5,001	5,758	4,959	5,120	5,275	4,606	4,750	4,811	4,802	5,608	17	78,533	+ 648
Dundee City	1,061	1,192	1,195	1,063	1,030	1,073	1,126	1,144	1,087	1,187	49	55,837	+ 2,331
East Ham Corporation	1,046	1,170	815	841	817	826	869	814	896	870	4	3,073	- 121
Exeter Corporation	292	332	278	282	311	231	251	261	270	377	4	1,027	+ 39
Falkirk and District	326	325	271	257	270	263	296	261	280	262	4	1,099	- 24
Glasgow Corporation	17,434	18,956	17,059	17,055	19,080	16,877	17,640	17,459	17,504	17,665	47	816,434	+ 15,596
Glossop (Urban Elec. Supply Co.)...	164	144	121	130	128	120	115	111	150	130	17	2,006	- 128
Hastings and District	1,934	943	927	927	788	846	811	838	1,676	865	17	13,735	- 380
Huddersfield Corporation	1,603	2,245	1,340	1,482	1,442	1,474	1,524	1,429	1,562	2,004	4	6,519	+ 10
Hull Corporation	2,509	2,594	2,195	2,215	2,216	2,496	2,501	2,375	2,479	2,493	4	8,924	- 89
Ilford Corporation	555	644	422	438	413	288	419	409	469	435	4	1,559	- 129
Ilkeston Corporation	206	116	206	117	117	129	129	130	123	161	4	543	- 14
Ipswich Corporation	433	443	327	351	343	310	331	318	386	365	4	1,275	- 77
Isle of Thanet	506	665	349	353	355	257	271	268	423	528	17	4,344	- 574
Keighley Corporation	149	242	137	136	147	141	155	150	146	...	42	6,548	+ 262
Kilmarnock Corporation	149	172	150	139	144	150	142	143	145	149	49	7,636	- 202
Lanarkshire	1,151	1,439	1,167	1,141	1,253	1,210	1,225	1,275	1,249	1,562	16	20,325	+ 2,800
Lancashire United	1,179	2,613	1,050	1,077	1,075	1,184	1,258	1,222	1,159	2,193	16	19,628	+ 1,037
Leeds City	6,673	8,198	5,683	6,001	6,089	6,207	6,244	6,124	6,534	6,797	4	23,312	+ 323
Leicester Corporation	2,306	2,736	2,116	2,027	2,023	2,099	2,199	2,120	2,124	2,366	17	35,209	- 244
Leith Corporation...	495	543	473	464	483	480	481	493	486	488	49½	25,335	+ 155
Leyton U. D. Council	1,231	1,528	856	911	871	827	890	844	1,007	1,076	4	3,393	- 235
Liverpool Corporation	11,251	11,797	10,211	10,256	10,515	11,276	10,801	10,519	10,749	10,885	17	172,769	- 1,774
London County Council	30,235	33,850	27,983	28,996	28,550	31,025	31,879	31,291	31,984	...	3	82,134	+ 8,161
London General Omnibus... ...	20,832	22,212	19,347	20,614	20,353	18,460	19,661	19,280	19,204	18,929	17	302,640	- 19,225
London Road Car...	7,939	8,419	7,484	8,244	7,993	7,549	7,998	7,820	7,826	7,093	17	111,467	- 6,672
London United	6,948	8,948	5,400	5,590	5,444	5,386	5,889	5,579	6,490	6,952	17	89,741	- 2,472
Lowestoft Corporation	180	207	142	138	139	130	138	138	171	177	30	4,664	+ 114
Maidstone Corporation	...	...	...	...	...	156	175	157	199	189	4	657	—
Manchester Corporation	15,885	16,193	12,997	13,345	13,665	14,168	14,195	14,161	15,521	15,494	4	54,094	+ 4,197
Nelson Corporation	207	147	123	122	129	126	127	130	189	126	3½	539	- 128
Newcastle-on-Tyne Corporation ...	4,229	4,932	3,785	3,741	3,893	3,717	3,757	3,671	3,916	4,300	4	14,289	- 1,655
Newport (Mon.) Corporation ...	694	804	597	596	603	602	605	629	641	724	4	2,601	- 1
New St. Helens and District ...	651	1,123	600	587	591	620	682	663	600	962	43	29,669	+ 772
Northampton Corporation... ...	418	624	376	374	378	388	411	398	395	521	3½	1,473	- 102
Oldham Corporation	2,250	2,241	1,729	1,752	1,803	1,902	1,920	1,863	2,195	2,030	5	9,433	- 344
Portsmouth Corporation	2,087	2,655	1,659	1,678	1,661	1,460	1,605	1,666	1,825	2,019	4	6,525	- 840
Preston Corporation	661	986	665	650	657	646	689	687	653	889	17	11,477	- 159
Provincial...	1,947	2,358	1,448	1,497	1,448	1,380	1,438	1,522	1,897	1,972	30	44,075	+ 656
Reading Corporation	601	497	573	567	580	541	414	557	569	659	3½	1,938	+ 55
Rochdale Corporation	1,582	1,313	955	1,192	969	1,034	1,059	1,059	1,546	1,194	4	4,454	—
Rossendale Valley...	221	226	184	184	194	190	211	184	216	211	17	3,114	- 52
Rotherham Corporation	558	502	515	514	552	582	115	586	585	780	3½	2,084	- 15
Salford Corporation	6,225	4,414	4,208	4,202	4,322	4,394	4,392	4,717	5,368	4,469	4	17,840	- 715
Sheffield Corporation	5,807	6,145	5,053	5,174	5,444	5,487	5,448	5,447	5,503	5,642	4½	25,080	- 1,698
Southampton Corporation... ...	848	648	919	876	864	841	776	921	942	1,127	3	3,090	+ 103
Southend-on-Sea Corporation ...	287	580	299	283	289	267	286	296	286	491	4	1,113	- 25
South Shields Corporation ...	678	693	492	504	541	505	511	500	581	536	3½	1,935	+ 38
Sunderland Corporation	1,472	1,551	1,213	1,245	1,279	1,062	806	1,087	1,214	1,091	4	4,198	- 1,091
Swindon Corporation	...	250	150	156	142	146	146	138	139	168	4	591	- 107
Tyneside Tramways and Tramroads	412	993	371	395	406	324	348	339	337	749	17	5,995	- 792
Wallasey U. D. Council	962	1,034	728	709	736	791	787	756	848	939	3½	3,043	- 69
Walsall Corporation	518	730	400	401	407	521	529	530	530	648	17	8,678	+ 981
Walthamstow Corporation... ...	696	546	462	490	460	506	306	511	680	625	4	2,121	+ 158
Warrington Corporation	...	455	472	351	365	...	371	469	376	418	3	1,162	+ 103
West Ham Corporation	2,340	3,240	2,076	2,195	2,144	2,020	2,165	2,050	2,067	2,474	4	8,758	- 899
Wigan Corporation	1,238	1,096	1,072	1,124	1,142	1,279	1,339	1,301	1,375	1,532	3	4,704	- 563
Wolverhampton Corporation ...	1,185	786	1,197	770	772	803	769	898	742	1,044	3	2,684	- 56
Yorkshire (West Riding)	1,377	1,696	952	1,031	1,122	1,096	1,105	1,102	1,229	1,347	17	18,530	+ 387
FOREIGN TRAMWAYS.													
Anglo-Argentine...	16,440	18,423	17,819	17,611	17,008	18,841	20,051	19,289	17,393	18,389	17	313,233	+ 35,003
Auckland ... ...(month)	9,846	...	...	...	...	11,212	...	...	...	...	13	37,100	+ 4,948
Bombay	1,922	1,869	1,902	...	...	2,340	2,498	2,473	...	...	14	33,979	+ 5,936
Buenos Ayres and Belgrano ...	3,971	3,449	4,134	3,938	3,900	3,879	3,924	4,153	3,941	3,550	17	60,427	+ 395
B. Ayres Grand Nat. & New (Joint)...	6,705	7,420	7,148	7,115	6,998	7,860	8,302	8,014	7,717	7,351	16	124,430	+ 15,813
Calcutta ... ... Rs.	43,456	44,509	44,132	46,726	45,750	45,486	48,628	...	44,144	44,460	16	785,116	- 35,387
Kalgoorlie ... ...(month)	...	...	...	...	...	4,264	...	...	...	...	13	11,319	—
Lisbon ... ... M	...	...	...	...	...	120,041	...	...	...	...	13	347,140	—
Madras ... ... Rs.	20,641	(2 weeks)	16,830	(2 weeks)	17,315	19,446	(2 weeks)	18,861	(2 weeks)	18,651	17	153,876	+ 15,986
Mexico ... ... $	410,282	...	...	...	...	442,093	...	...	...	...	13	1,270,146	+ 146,664
Perth (W.A.)	1,446	1,608	1,482	1,429	1,388	1,336	1,442	1,403	1,445	1,528	17	24,143	- 936
Rio de Janerio ... ...(month)	101,818	...	...	...	...	117,260	...	...	...	...	13	336,593	+ 44,684
Sao Paulo... ... (month) $	183,713	...	...	...	...	199,299	...	...	...	...	13	577,719	+ 47,194
Singapore ... ... $	9,816	10,794	10,311	9,837	9,591	8,839	9,690	9,856	9,488	8,964	30	278,106	+ 4,243
ELECTRIC RAILWAYS.													
Baker Street and Waterloo ...	1,950	2,230	2,380	2,480	2,470	3,085	3,075	2,980	2,720	3,485	17	52,450	+ 12,629
Central London	5,204	5,564	6,127	6,236	5,860	5,887	6,054	5,914	4,994	5,532	17	101,878	- 3,573
Charing X Euston & Hampstead ...	...	...	...	...	...	3,140	3,210	3,100	3,190	3,665	17	54,065	—
City and South London	2,408	2,689	2,988	2,836	2,825	3,279	3,173	3,140	2,858	3,432	17	56,467	+ 6,225
Great Northern and City	1,596	1,705	1,846	1,849	1,813	1,612	1,666	1,648	1,537	1,594	17	29,828	- 1,712
Gt. North'rn, Piccadilly, & Brompton	3,440	3,680	3,910	4,080	3,975	5,485	5,685	5,385	4,990	5,660	17	91,925	+ 27,541
Liverpool Overhead	1,429	1,593	1,367	1,397	1,465	1,386	1,424	1,362	1,324	1,477	17	23,493	- 230
Mersey	1,809	2,005	1,979	1,782	1,788	1,903	1,918	2,084	1,897	2 036	17	33,671	+ 1,508
Metropolitan	13,672	16,145	15,416	15,005	15,369	15,083	15,373	15,530	14,115	16,026	17	258,483	+ 2,476
Metropolitan District	6,932	7,259	7,897	8,042	7,722	8,940	9,276	8,702	8,102	8,633	17	150,932	+ 16,758

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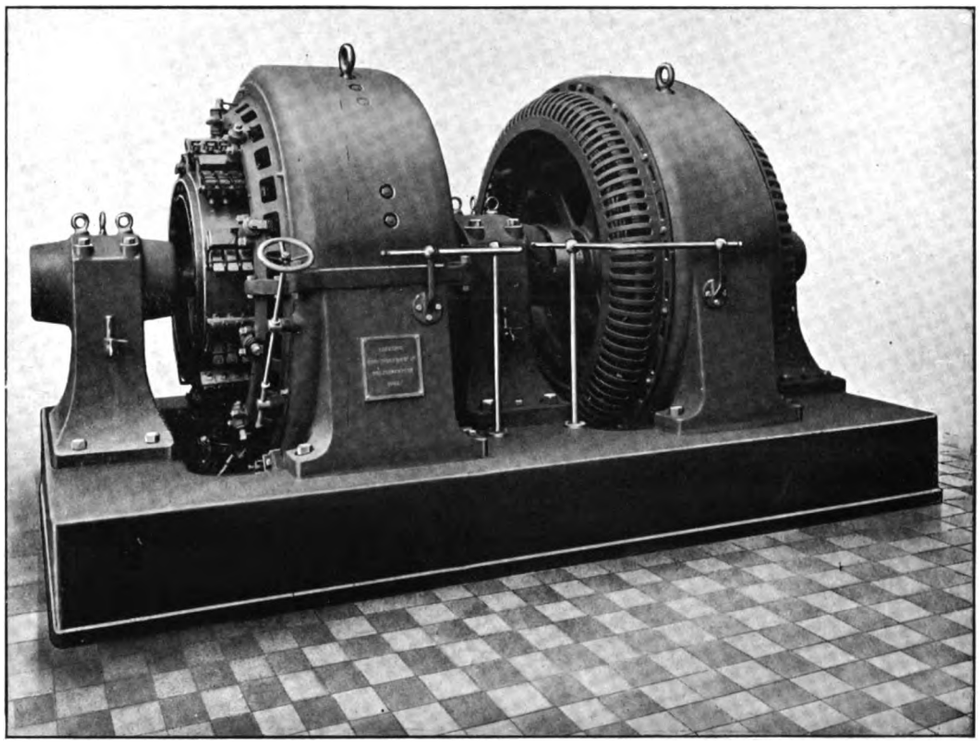

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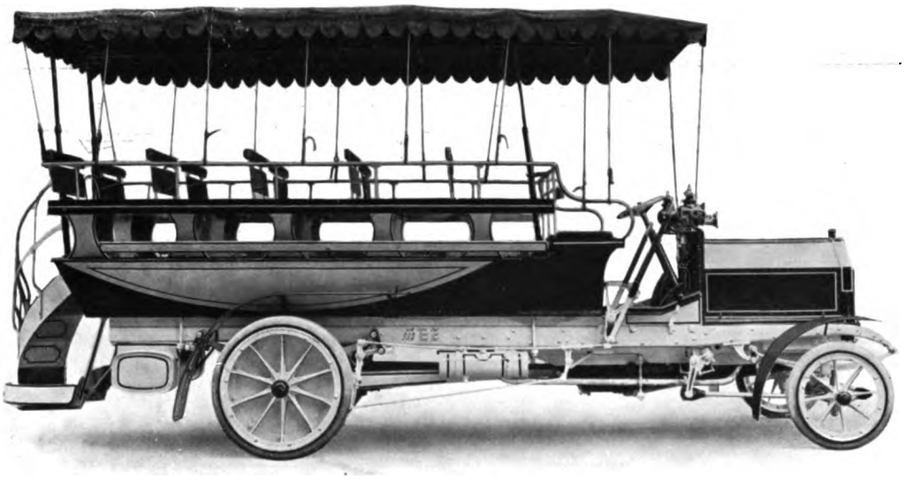

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AN OPINION "AFTER 16 MONTHS' CONTINUOUS RUNNING."

SILSDEN MOTOR OMNIBUS CO., LTD.,
nr. Keighley, Yorks., Nov. 13, 1907.

Dear Sirs,

With reference to the Motor Omnibus which you supplied to us in July, 1906, after 16 months' continuous running we are pleased to report to you that the good opinion we at first formed of your 'Bus has been more than justified by results, **and we congratulate ourselves in owning what we consider to be the best 'Bus on the market.** In consumption of Petrol and Oil she is remarkably economical. As to repairs your ledger will disclose that **our purchase of parts, &c., from you during the last six months have not exceeded £5,** which fact speaks volumes for the excellent workmanship of your Chassis. She requires a minimum amount of attention to keep her at concert pitch, and we can always depend on her carrying her complement of passengers (40) with ease up the long and steep gradients so numerous in this locality. We have nothing but unstinted praise for the manner in which your 'Bus has done its work on our country roads since July, 1906.—Yours faithfully,

p. pro **Silsden Motor Omnibus Co., Ltd.**
(Signed) M. P. CRYER, Secretary.

RYKNIELD MOTOR CO., LTD.,

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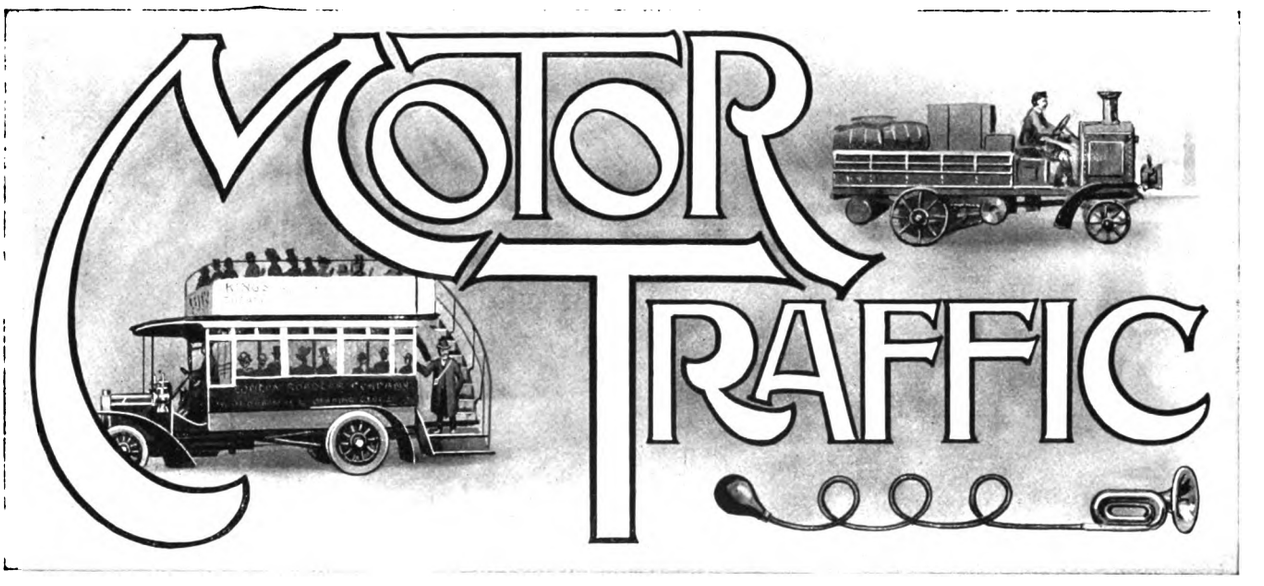

In the present issue we give a description of the recent exhibition of industrial motor vehicles. Among the exhibitors there was necessarily much variety of opinion as to the amount of benefit which they were likely to derive from the exhibition. Undoubtedly many orders were booked, and the inquiries from motor users were of such a nature as to encourage the belief that many more orders will be given in the near future as a result of what was seen and learned at the show. Some people complained of the smallness of the attendance of the public at the show. This, however, is more or less a feature of all trade exhibitions, and the success or failure of such shows from the manufacturers' point of view is by no means to be measured by the number of the general public—the vast majority of whom are not potential buyers—who come simply to look at things. The point to be aimed at is to get the right class of people to come, the people who are likely to buy industrial motor vehicles.

Although the attendance of the officials of the municipal corporations and railway companies was most unsatisfactory, the fact that the North Eastern, Great Eastern, and Lancashire and Yorkshire railways have each decided to make exhaustive trials with a heavy chassis which was exhibited on one of the stands clearly shows that the railway companies are prepared seriously to consider the adoption of motor vehicles on a large scale just as soon as they are satisfied that they have found a type of chassis suitable for their requirements. The volume of business which will ultimately accrue by the more general adoption of the motor vehicle by the railway companies and the municipal authorities is so great that manufacturers should be stimulated by the practical interest shown by the companies mentioned, and make special efforts to insure the attention of those likely to be concerned in public service vehicles.

Unfortunately for the manufacturers there appears to be something very much like a slump in heavy motor vehicles at the present time, and in looking for the cause of this we have come to the conclusion that it is probably due to two causes. In the first place an ill-informed press has led the user to expect more than it was possible to obtain from the use of this class of vehicle; and in the second place, certain impatient manufacturers, anxious to make the most of the motor omnibus boom, supplied a large number of vehicles which were quite unsuitable for the service required of them. Even to-day a broken-down motor 'bus, particularly a certain type, is a common sight in London. Under these circumstances it is only natural that those who are responsible for the maintenance of a regular service, either for passenger traffic or the delivery of goods, will be very careful in making a selection of the types of chassis to replace their horse-drawn vehicles.

A lesson to be learned from the meagre attendance of those interested in public service vehicles is the fact that the majority appear to be more or less satisfied with their present methods. It is obvious, therefore, that as "the mountain will not come to Mahomet, Mahomet must go to the mountain." In other words, if the manufacturer is to obtain the vast amount of business which will come as a result of the desired change from horse traction by our municipal authorities and railway companies, special efforts and a considerable amount of educational work will be necessary.

A point of interest in the motor show was the total number of vehicles and chassis exhibited. Mr. H. Hewitt Griffin, a very competent authority, has published some reliable statistics in our contemporary, *Motor Traction*, which give under a variety of classifications the number of vehicle exhibits at this show, at the show of last year, and at the two corresponding exhibitions in Paris. From the tables it appears that the total at Olympia last month was 215, as compared with 194 a year ago, while the figures for Paris were respectively 167 and 130. Britain is evidently ahead in this matter at least. At this year's Olympia show the number of vehicles and chassis for passenger service was 76, while those for goods numbered 139. In regard to means of propulsion 178 were petrol vehicles, 28 were steam, two were petrol-electric, five were electric only, and two were paraffin. As to nationality 168 were British, and 47 foreign.

We were informed by the representatives of some of the exhibitors at the show that the arrangement for maintaining vehicles by contract is growing in favour, and we are not surprised. To the small user, such a plan presents many advantages. Before it can come into very general use, however, it will be necessary for the manufacturers to appoint trustworthy repairing agents all over the country, and steps to this end are, we were assured, in some cases already in progress. The small user often lives in a small town, and a

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MOTOR TRAFFIC.

maintenance contract is of no use to him unless there is some firm or individual in his locality to carry out the maintenance on behalf of the manufacturers of the van, lorry, or whatever it may be. These repairing agents might also act as sales agents, so that benefit might accrue in more directions than one.

THE SECOND COMMERCIAL MOTOR VEHICLE EXHIBITION.

It would not be easy to point to any other instance in which such a powerful combination as that of the Society of Motor Manufacturers and Traders has reached a similar pitch of development and strength in the short period since its foundation. It is often said that the Society controls practically the entire trade and industry of motor car manufacture, and there is little doubt that for a long while to come it will play an important and useful part in the progress of the motor car.

The Society rises, indeed, almost above all considerations of bad trade and general depression, and therein lies its great usefulness to the motor world, for its continued success both obtains and gives proof to the world that motors are not mere fashionable toys or things of to-day, but have come into a definite inheritance whose boundaries are not easily seen or even conceived. However great the fall in volume of general business, the Society's growth continues, and its constituent members cheerfully support its movements in the knowledge that in a short while the good results will be clear. Otherwise one might be tempted to ask, in regard to the Society's two annual motor exhibitions at Olympia, whether in these days of stress—when every well-to-do man who might conceivably buy and run a motor car sees the investments that he has been taught to consider gilt-edged dropping to one half their normal price or less, when business firms find their trade diminishing and profits sometimes of a negative quantity,—it does not seem, in view of these circumstances, an almost useless expense for the members of the Society to bring together specimen products from their works or warehouses to show the public what the latter should buy if they were in a position to do so.

But even in the bad times through which we are now passing there are firms who are doing well, and if there appears to be any lack of progress, it is to be attributed to the fact that manufacturers have been engaged in searches for improvement which have not yet proved successful, rather than to the actual want of sufficient business to render improvements worth the making. This is the simple explanation of the remark frequently heard that the motor world is "marking time," but it will not surprise those who are behind the scenes if this period of apparent inaction is shortly to have very important results.

The November show of pleasure cars at Olympia was probably the best and most profitable of all the series held by the Society, both financially and technically; and the exhibition at Olympia last month of commercial vehicles and motor boats, though only the second of its kind, must also be acknowledged to have easily surpassed the first one. Yet the conditions of general trade and business during the past two years have become worse rather than better; and one can, therefore, only conclude that the motor industry, though doubtless obliged to suffer from outside causes as well as from a rapid internal expansion, is now on a firm basis, and with good guidance will be one of the factors that shall tend to keep this country in the prominent, if not indeed pre-eminent, position it has always held throughout the world.

There need not be much doubt that the third exhibition of commercial vehicles to be held next year will show still more plainly what an enormous mass of business may be done in this direction, given more confidence amongst users, and ability to extend their trade. Probably the number of those now engaged in this part of the industry may not be any greater—may be even less owing to combinations and amalgamations,—and as vehicles for certain definite purposes become more standardized, even the number of these on show will be less, since people get tired of seeing endless replicas of half-a-dozen leading types or designs.

The commercial vehicle of to-day is, however, a proved appliance, and for the next five or ten years should find a ready acceptance amongst those for whom it has been designed, and that in their own interests of economy and time-saving efficiency. There will be, of course, some very great improvements brought out, perhaps too of a fundamental character, but these will not be of such nature as to render obsolete the vehicles of to-day's design; they will lie rather in modifying the types for certain special purposes. Thus, for example, the recent show with which we are now dealing, contained not a single specimen either of a six-wheeled motor 'bus, of a 'bus worked by producer or suction gas, or a cab or light delivery van employing electric accumulators of a new type such as that ascribed to Edison, which contains no lead at all, but is formed of nickel and iron in an alkaline solution, and presents advantages of most far-reaching value in regard to low weight, great mechanical strength to withstand vibration and heavy charges or discharges of a rapid nature, cheapness of construction, and low maintenance cost.

Yet all these developments will probably within the next five years take a prominent place in commercial motor vehicle work for the particular purposes mentioned above; but their progress will be of a slow and steady kind, so that existing types will not by any means fall out of use.

Dealing with the exhibition broadly, it may be said that no very striking novelties were displayed—perhaps not even so many in comparison as were seen at the first of these shows a year ago. The technical visitor would doubtless find great improvement in detail—in strengthened frames, more reliable brakes, quieter and more durable change gears and driving mechanisms, simpler and more accessible engines; and all these tend to show not merely that the industry has found its feet, but also that makers have profited by experience, and strengthened the parts proved weak by daily wear and tear. The exhibits fall naturally into three principal sections, viz.: petrol vehicles, steam tractors or wagons, and motor boats. It is the first section that we have had more particularly in view throughout the above remarks. The steam section, including the heavy wagons say of five tons and over, represents vehicles that if only by reason of long experience in steam engineering have reached a high pinnacle of perfection. There is but little possible improvement in the steam motor except in detail of design, workmanship, or material, and apart from such features of an uncertain value as the use of superheated steam, etc.

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MOTOR TRAFFIC.

The third section, comprising the motor boats, included perhaps for convenience in a Commercial Vehicle Exhibition, can at present hardly be considered of superlative interest to the man who employs motors for business purposes only. The types so far on the market are almost entirely intended for private pleasure use; the motor ferry boat or passenger vessel has not as yet made much of an appearance, nor is it to be expected at an exhibition held on shore inland, where such bulky vessels could hardly be conveyed except in pieces. For the adequate display of this section in its truly commercial aspect, it would be necessary for the executive to show motor vessels actually on the water; and this—needless to remark—is hardly possible at present.

The principal features of novelty amongst the petrol vehicles will be gathered from our detailed description of exhibits that follows. Speaking broadly, the past year's developments present themselves in the direction of motor cabs, of which many well-designed specimens were shown; light delivery vehicles of carrying capacity up to, say, 15 to 20 cwts.; and heavy chassis suitable for weights of three to five tons. All these are consequents of demand from the public; and it is especially pleasing to see that in all of them the British maker has little or nothing to learn from his foreign competitor in regard to accepted designs, material, and workmanship.

The real ultimate field of the petrol commercial vehicle will probably lie in the use of chassis to carry from 30 cwt. to 3 tons, yet the public demand for such is only slowly increasing, and comes almost wholly from those who already have had several years' experience of commercial motors. The difficulty is that users of motor vehicles begin their experimental services with small sizes, as involving less outlay, and in many cases the results for this very reason are not so favourable as they would be if a bold plunge were made at once, and absolutely the most suitable vehicle obtained at the outset. The small vehicles should follow the large ones, not *vice versa;* but each year sees the position more consolidated, and development proceeding on logical lines. At present, the small van or cab chassis, where designed on proper lines, and not merely from pleasure car practice, is about as good as a user can expect to get in this imperfect world; the extra heavy types are also being worked out satisfactorily owing to the demands of motor 'bus traffic. The intermediate types have been good all the way through, being specially designed for rough work from the outset; and now it is only the buying public that requires to be aroused to a knowledge of this fact.

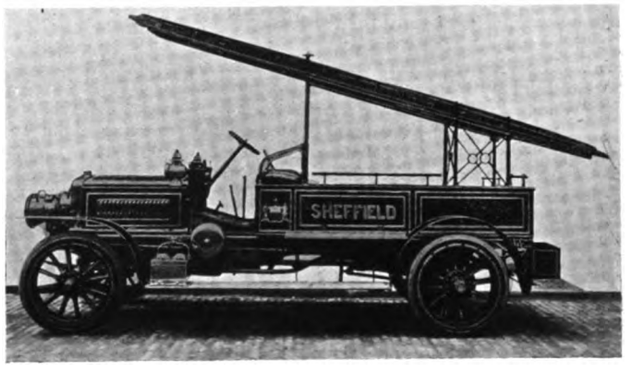
We have no doubt that this has been at least one useful result of the recent show, and though perhaps not much actual business was done at the time in the way of booking orders, the exhibitors will already, we expect, have begun to gather the harvest coming to their efforts as pioneers in sowing the seed in very adverse times.

It may be advisable to throw more energy into the working out of the steam 'bus, for good as it is at present in the makes of Darracq-Serpollet, Critchley-Norris, Leyland, and others, something still remains to be done before makers can claim the same reliability, ease of driving, and absence of generator or burner troubles, as they are able to do with regard to elasticity, quietness of working, and economy.

The field for steam commercial vehicles is undoubtedly for weights of five to ten tons, and the only competitor in all probability will be a producer or suction gas system of some really reliable type. This, as we have said, though likely to come and succeed, is still some distance away.

SOME OF THE EXHIBITS.

Argyll Motors Limited, Alexandria, Scotland.—A 14-seated, 20 H.P., single-deck 'bus shown by this firm is arranged with side doors at the fore end so that the driver can collect the fares. There is ample luggage accommodation on the roof, and the vehicle is well suited for the requirements of railway companies and hotel proprietors in country districts. A 12-14 H.P. cab, with seats for four passengers, is of a type now in use in London, Manchester, and Edinburgh. The four-cylinder engine, clutch, and gear box are all in one casing, and can be removed



Argyll Fire Brigade Wagon.

bodily by unscrewing four bolts. The two seats with their backs to the driver fold up, and, when they are let down, comfortable arm rests come into position. This cab can be turned in a road 23 ft. 6 in. wide. The other vehicles shown included two lorries, a delivery van, and a first-aid machine for fire brigade purposes, carrying a light extension ladder on top.

Sir W. G. Armstrong, Whitworth and Company, Limited, 3, Blenheim Street, New Bond Street, London, W., exhibited a 28-32 H.P. delivery van and a heavy lorry or omnibus chassis fitted up as a military transport wagon. The latter vehicle is so designed as to serve for a double purpose in transport, that is, it can either be used

Argyll Motor Cab.

for the conveying of troops, or in the space of a few minutes, it can be transformed into a wagon suitable for carrying baggage, stores, etc. If necessary, it can also be arranged for one part of the wagon to be used for baggage, while the other is available for passengers. One very important feature of the design is that there are no extra parts

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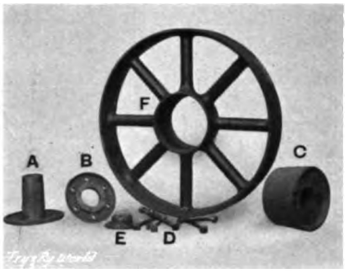
required to convert from one type of wagon to the other, this being done by the re-arranging of the existing parts. Steel standards are fixed at each side, and on these the seats rest. The seats are made in two parts hinged together, one part forming a back rest. When it is necessary to convert the vehicle from a passenger to a baggage wagon, the seats, which are portable, are lifted out and used to form the sides. The necessary fastenings for securing these sides are already fitted, and the change can be made in two minutes. There is also provided a locker in which 6,000 rounds of rifle ammunition can be carried. Suitable clips are also provided on the back of each seat for the housing of rifles. A folding table is fitted to the dashboard for the use of the officer in command who may wish to consult maps, etc. Eye-bolts are supplied with rings suitable for securing baggage with ropes if found necessary. Two of the eye-bolts are fitted large enough for taking block and tackle.

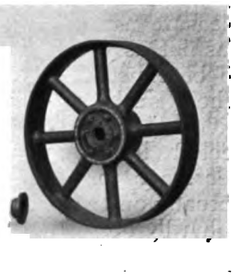
The Acetylene Illuminating Company, Limited, 268, South Lambeth Road, London, S.W.—The feature at this stand was what is described as a dissolved acetylene outfit for lighting motor vehicles. By this means acetylene gas lighting can be used without the trouble of carrying about an acetylene generator, carbide of calcium, and water. The gas is introduced into cylinders containing acetone, which is capable of absorbing a great quantity of the gas. A governor or reducing valve keeps the pressure of the gas at the burners constant. When a cylinder is exhausted it is returned to the agents of the company, who stock cylinders ready for use. Specimens of "autogenous" welding, carried out by the oxy-acetylene blow-pipe were also exhibited.

The Atlas Engineering Company, Levenshulme, Manchester, were showing their patent resilient road wheels suitable for all classes of commercial vehicles. There are two types of these wheels, the "Herculean" and "Samsonian," but in each case the resiliency is obtained by the use of wood under compression in conjunction with a cast steel wheel. In the former type a layer of wood is placed in the grooved felloe, and an iron tyre forced on in such a manner as to compress the wood sufficiently for it to insure a tight fit even when the tyre is stretched by constant use. The "Samsonian" type of wheel is also of cast steel, but with a cone-shaped wood centre fitted between the steel hub and the wheel casting. As the wood cone is compressed by means of a cap being bolted to the hub flange, it is claimed that any tendency of the spokes to twist the hub casting is compensated by the expansion of the wood centre. Broken spokes, so prevalent with all cast wheels, are thus entirely prevented. Both types of wheels have been in successful operation during the past year, and amongst the users are the Bristol Tramways Company, Vanguard Motor Omnibus Company, Great Central Railway Company, Great Eastern Motor Omnibus Company, and a number of railway carting agents.



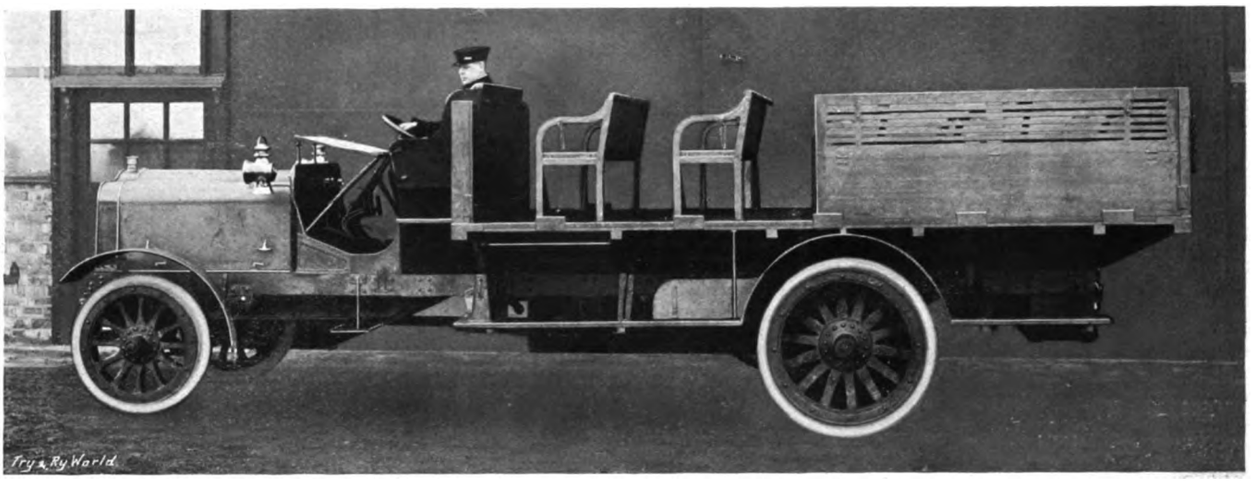
Samsonian Wheel in Parts.

'Bus Type of Samsonian Wheel.

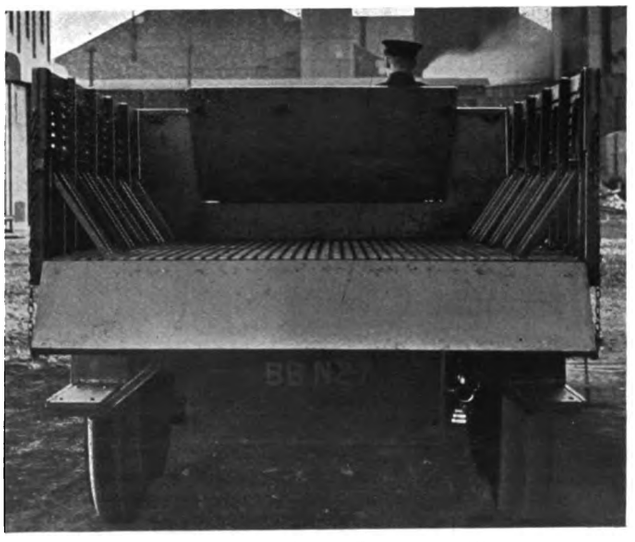


Lorry Wheel fitted with Samsonian Hub.

Atlas Engineering Company.



Armstrong-Whitworth Military Transport Wagon.



Interior View of Military Transport Wagon.

Berna Motors, Limited, 3, Lombard Street, London, E.C.—The leading exhibit on this stand was the chassis of a 35 H.P. 4-cylinder, 5-ton lorry, a type of vehicle which has done much good work in the past, and now shows little modification except that it is fitted with two ignitions, magneto and accumulator, and an oil filter has been added. If oil contains any solid impurities when purchased, these are thus filtered out before the oil is sent into the crank chamber, whence it is forced to all the bearings. The Lowcock Commercial Motor Company, Manchester, after using one of these lorries during nine months of last year over the worst roads of Lancashire, Yorkshire, Derbyshire, and Cheshire, have supplied figures which show among other things the following gratifying results; miles run, 6,688; tons carried, 664½; average tons per day, 4½; average miles per day, 42·6; miles per gallon of fuel (mostly petrol), 7·52; average speed, 10·77 m.p.h.;

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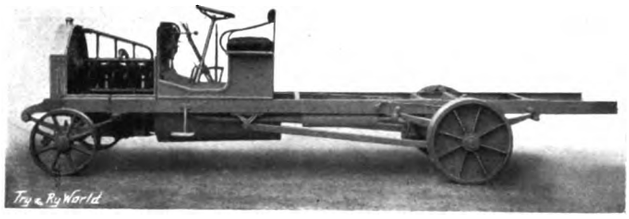
working cost per ton mile, including 20 per cent. depreciation, 3·06d. Sometimes there was a very small load and sometimes the machine ran unloaded. Running regularly with full load the cost it is claimed is got down to about half the above figure per ton mile. A photograph was exhibited at the stand showing one of these lorries loaded with a large gas tank which it transported from Oldham to



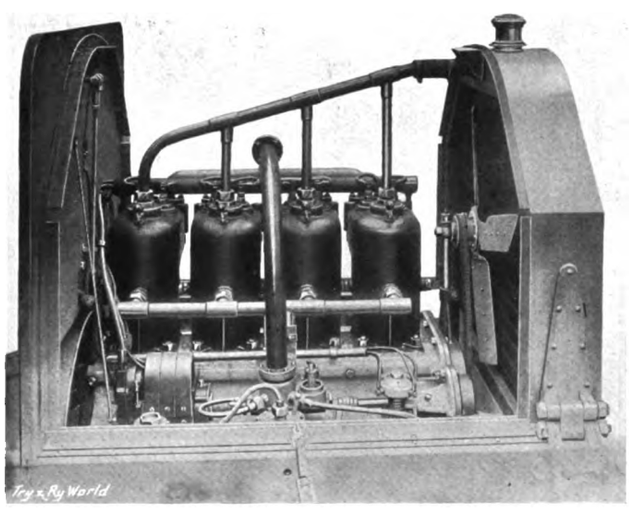
Berna 5-ton Lorry.

the West India Docks, London, a distance of 210 miles in 18 hours. The total height of the load from the ground was 15 ft., and the lorry was employed because the tank was too high to go by railway owing to the limited head room at bridges. The total weight was 5 tons 4 cwt., and the lorry appeared to have no trouble in carrying out the work. Other exhibits of this firm were a laundry van, a platform lorry, and a chassis, each of 18 H.P. and load capacity of 2½ tons, and a 14-16 H.P. 4-cylinder cab chassis.

Brampton Brothers, Limited, Oliver Street, Birmingham, and 138, Long Acre, W.C.—This well-known firm of chain makers showed numerous examples of their driving chains and sprockets suited for commercial motor vehicles. The chains have various improvements in detail.

J. W. and T. Connolly, Limited, 57-67, Wharfdale Road, King's Cross, London, N.—Solid and pneumatic tyres and artillery wheels for motor vehicles were shown by this firm. The solid india-rubber tyres for heavy vehicles are fixed to the rim by steel wires on either side.

The Coventry Chain Company (1907) Limited, Spon End, Coventry.—The driving chains made by this company are well and favourably known. Among the wide variety shown was the "wormo" roller, which is designed to reduce noise, increase lubrication, and to have great durability. This chain was shown in larger sizes than have before been made. The roller is formed of a flat bar of steel rolled up spirally



View of Engine—Berna 5-ton Lorry.

Clarkson, Limited, Chelmsford.—This company, as usual, confined themselves to the steam-driven vehicle, and showed a 32 H.P. double-deck omnibus to seat 34 passengers, and a 3-ton van on a similar chassis. Paraffin fuel, Clarkson's burner, and the enclosed self-lubricating engine, are retained, bnt there are several new points. The design of the boiler has been altered to the Climax water-tube type, in which there is a central steel shell surrounded by curved generating tubes. The boiler is made so as to be quickly removed for the purpose of cleaning out the interior. The action of the burner is controlled automatically by the pressure of the steam, while the supply of water to the boiler is also automatically governed by a thermostat. The driver is thus relieved of attending to these two important matters. While the engine remains unaltered, the forced lubrication to all the bearings has been so perfected as to reduce the consumption of oil to half a gallon for 1,000 miles. The wheel-base of the 'bus has been lengthened to 12 ft. 5 in., so as to diminish the tendency to side slip. The front appearance of the omnibus has been improved, and the driver's seat has been somewhat lowered. It is stated that the London General Omnibus Company, who are running a number of these vehicles, are able to keep the whole of them in constant service. The lost mileage is under 1½ per cent., and some weeks it is as low as ⅛ of 1 per cent. The reason given for this is that there is now no adjustment or repair which cannot be done during the off hours of the night. Two days a month, and in addition a week in a year, are allowed for thorough overhaul. The cost of the annual overhaul is under £20. It is further claimed that the new type of Clarkson 'bus can be run for 9d. per mile, including all charges, compensation claims, and 20 per cent. depreciation.

Clarkson Steam Omnibus.

Commercial Cars Limited, Luton, and Cambridge Circus, London, W.C.—The chief object of interest at this stand was the 30-36 H.P., 4-cylinder, 3-4-ton car chassis which was run in the commercial vehicle trials. It was dismantled for exhibition after having run 6,315 miles with full load. The gear box was sealed prior to the trials, opened by the Automobile Club at the close of these runs, re-sealed by them, and was opened again at the beginning of the Exhibition and shown separately so that it could be closely examined. As the box has been sealed up during all the running since it left the shops, there has been no opportunity for inspection or adjustment. The gears showed no sign of wear, and appeared to be in first-class condition. When changing speed with this type of gear there is no need to de-clutch, but only to throttle down the engine so as to allow the gear to over-run the engine when the spring-actuated dogs on the shaft come into action. The gear wheels are always in mesh. An interesting adjunct shown fitted to a 30-36 H.P., 4-cylinder, 3-4-ton lorry was a small jib crane erected at the rear, and worked by the engine of the car. It is operated from the driver's seat by means of a clutch pedal. A sprocket takes the power from the main shaft of the engine to an auxiliary shaft, which runs back and drives the winding drum of the crane. Heavy goods can thus be quickly loaded or unloaded wherever the vehicle may be. Three chassis of the 24-26 H.P., 4-cylinder, 2-2½-ton type were shown, one fitted with a tilt van, and another with a char-a-banc body. The maintenance contract inaugurated by this firm is being very largely taken advantage of by users of their vehicles. Under this scheme the firm maintain the vehicles at a fixed price per annum, and all trouble and uncertainty as to repairs are obviated. Arrangements are being made for the appointment of contract repair agents all over the country.

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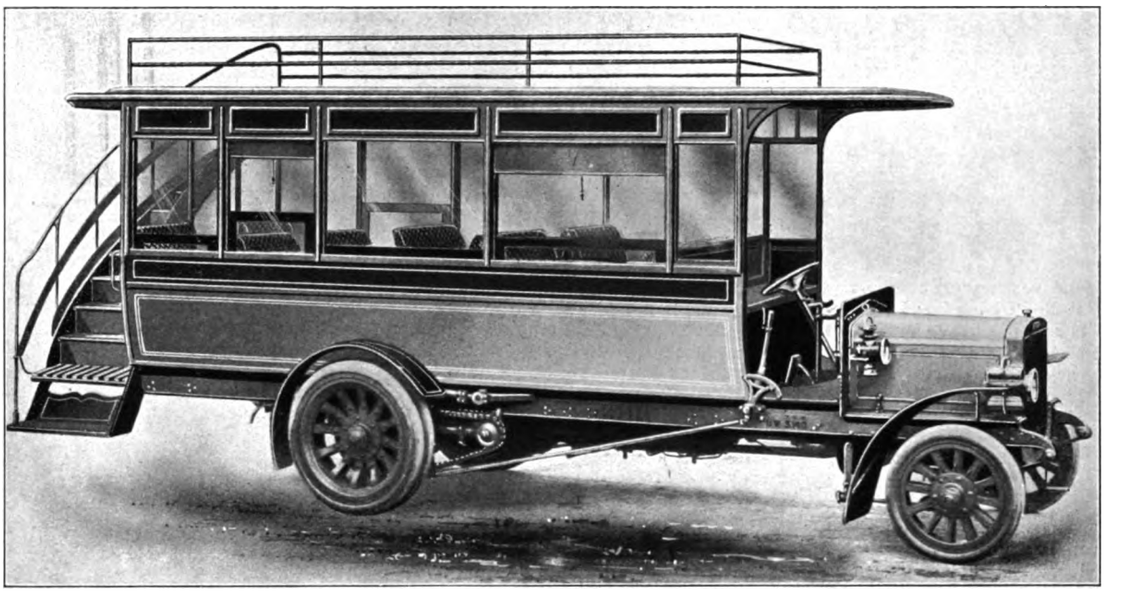
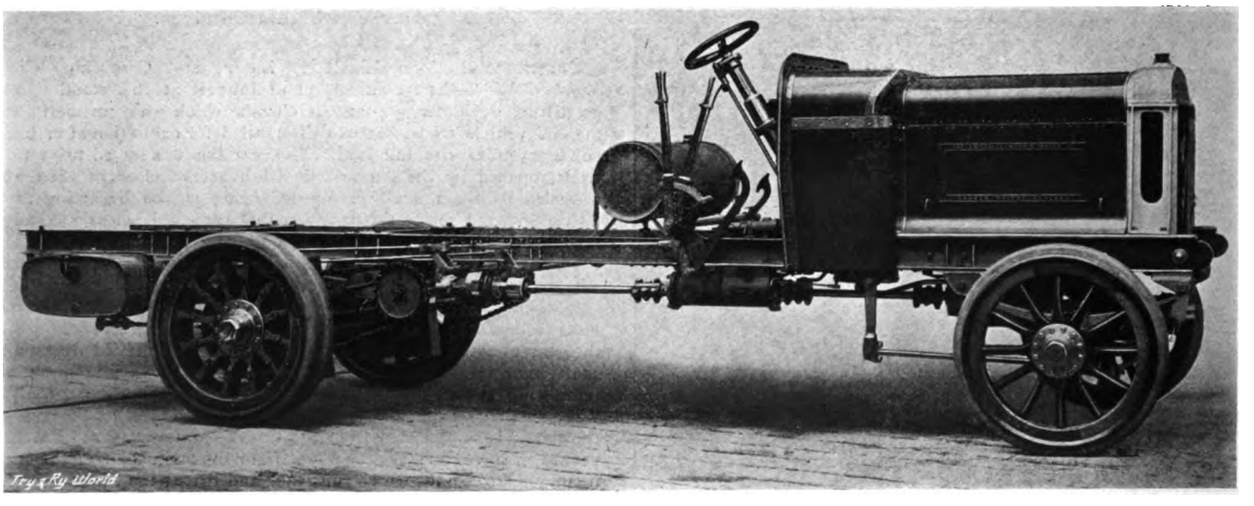
The Critchley-Norris Motor Company, Bamber Bridge, Preston, exhibit a petrol char-a-banc and a new steam chassis, suitable for either an omnibus or lorry. The latter was of a novel type, and was fitted with a three-cylinder engine. The generator is placed immediately behind the engine, the whole being covered by a hood or bonnet of somewhat larger dimensions than is usual for petrol vehicles of the same horse-power. The generator is carried on a steel plate attached to the frame, and consists of a mild steel drum with a number of coils of mild steel tubes arranged in such a manner as to obtain the greatest amount of heating surface in the given space.



Single Deck Omnibus—Commercial Cars, Limited.

Each coil consists of three turns, the ends being expanded into the central drum. Round the drum and over the coils is placed the feed-water heater, this being in the form of a continuous coil, and designed to superheat the steam to a temperature of 500 deg. Fahr. A removable cover permits of internal inspection of the central drum, while the whole generator can easily be removed from its seating should occasion require it. The burner is simple in form, and consists of a single jet, the oil passing through a coil formed in the tube becomes vaporised, and when ignited the flame impinges on an inverted cone-shaped deflector, round which it spreads in a thin film, thus being able to take up sufficient air for complete combustion. The flame is regulated by a needle inserted in the vent of the burner, operated by a lever on the steering column. The engine cylinders, which are of the single acting type, are cast in one piece together with the valve boxes. The inlet and exhaust valves are on opposite sides of the engine, steam admission and release being controlled by poppet valves operated by rocker arms carrying hardened steel rollers resting on the cams. The camshaft is of a special steel, and driven by gear wheels enclosed in the crank chamber, the cams being arranged to give cuts-off varying from 25 per cent. to a complete overlapping. The pistons are of cast iron, being specially ground to a slight taper at the upper end in order to allow for the expansion caused by the high temperature of the superheated steam acting on the piston head. Each piston is fitted with seven cast-iron rings, a groove being made between the fourth and fifth ring in order to allow the escape of any steam that may have passed the top four rings. This arrangement also prevents an excessive amount of lubricating oil from passing into the cylinders. The normal speed of the engine is 500 revolutions per minute; this gives 35 H.P. The speed, however, can be accelerated to 800 revolutions per minute. A condenser of the tubular type is placed in front of the engine. It is made with upper and lower headers, the upper portion containing a feed-water heater coil, while in the lower two oil filters are placed. A disc fan is also fitted; this not only assists in the cooling but also supplies a current of air to ensure perfect combustion in the burner. The water supply is maintained by a vertical pump of special design, driven by worm gears. The power is transmitted from



The Critchley-Norris Steam Chassis.

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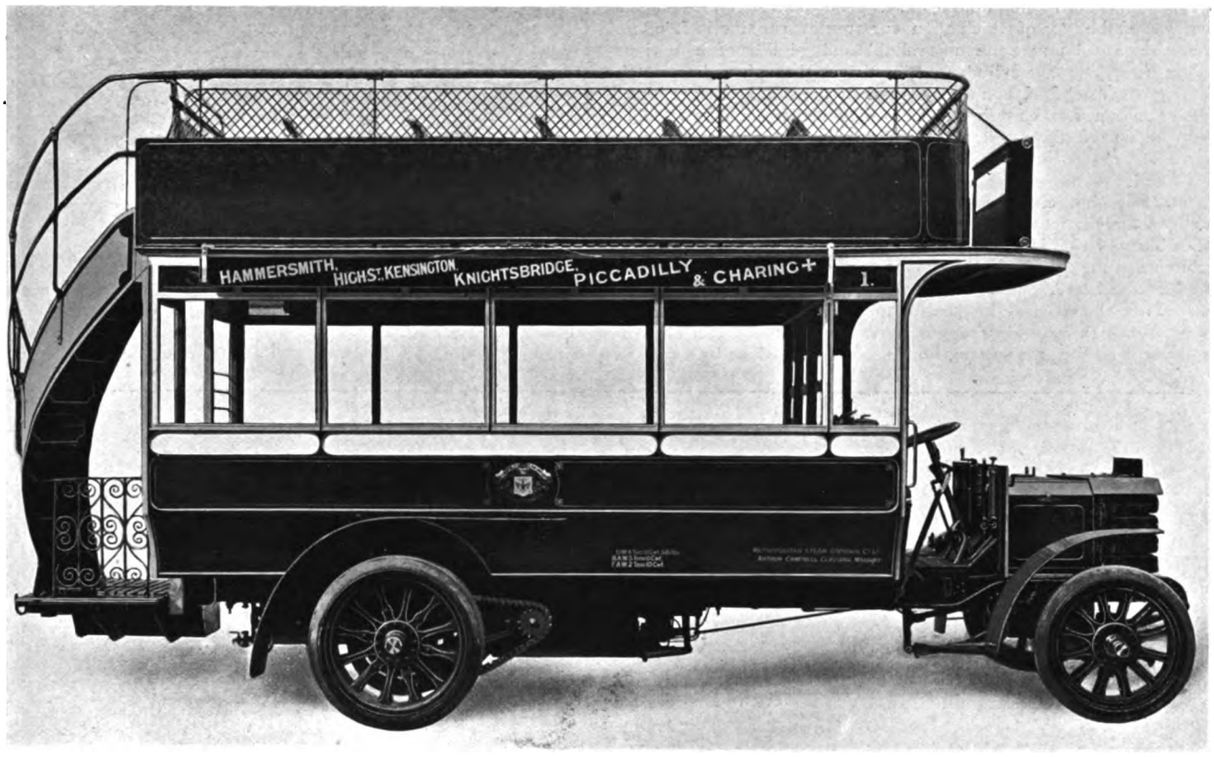
the engine by means of a short cardan shaft to a positive claw clutch under the footboard, and another shaft fitted with a universal joint takes the drive to the balance gear shaft, which is contained in a steel casing. From the sprocket on each end of this shaft the power is transmitted to the back axle by means of roller chains, which are completely encased. Two powerful brakes have been fitted, both of which act on the rear wheels. The pedal-operated brake is of the external or contracting type, and is of easy adjustment, while the emergency brake is of the internal expanding type, and completely enclosed. From the general appearance of the chassis it is obvious that special attention has been paid to the need for simplicity and strength in the design of the frame, while the absence of machinery beneath the body of the venicle should be much appreciated by those who may adopt this type of chassis.

The Daimler Motor Company (1904), Limited, Coventry, were showing one of the most interesting vehicles in the exhibition. This was an omnibus constructed for the Gearless Motor Omnibus Company. The vehicle is fitted with a chassis on the "Automixte" principle, and, although a similar 'bus is in actual service in Paris, this is the first of this type to make an appearance (otherwise than experimentally) in England. The engine is a four-cylinder Daimler, 120 mm. bore by 130 mm. stroke, rated at 30 H.P. It is coupled to a dynamo manufactured by Messrs. Dick, Kerr and Company, which also, when required, acts as a motor to assist the engine in the propulsion of the car. When not in use as a motor this machine is employed to charge a small battery of accumulators, from which it gets its power to act as a motor. The battery, which weighs about 7 cwt., is of the Tudor pattern, and is placed under the driver's seat. The vehicle is driven through an electro-magnetic clutch, and an electro-magnetic brake is also fitted. The engine, dynamotor, and clutch are bolted up together and mounted by a three-point suspension in the main frame, which is connected to the front axle by springs in the usual way. The back part of this frame, however, upon which is mounted the gearing by which the back wheels are driven, is entirely unsprung. The body is mounted on an independent frame, hinged to the under frame at the dash board, and supported by springs at the back. The under frame is made with as little bracing as possible, and has considerable flexibility sideways. The body, although free to move vertically on its springs, is saved from lateral motion by horn blocks at the back. The drive from the magnetic clutch to the back wheels is through a longitudinal shaft, driving a differential countershaft through a worm gear, with a final enclosed spur reduction gear to each wheel.

Darracq-Serpollet Omnibus Company, Limited, 15A, Amelia Street, Walworth Road, London, S.E.—The construction of the Darracq-Serpollet steam chassis has recently been described in our pages, and the vehicles shown did not reveal any material changes. They were, however, a very fine collection, and must have proved of great service to visitors previously unacquainted with their principles. The Serpollet system of boiler and engine has long been in existence, and may be regarded now as pretty nearly perfected, and its application to omnibus work in this country is being watched with keen interest by those who know anything of steam automobiles. The 30-40 H.P. double-deck omnibus shown was a sample of the type supplied to the Metropolitan Steam Omnibus Company. The first of these vehicles began running in London in August last, and it is reported to be doing very well. The other exhibits included a 20-25 H.P. 2-ton lorry, a 30-40 H.P. 3-4-ton chassis, a 30-40 H.P. 3-4-ton covered van, a 30-40 H.P. 4-ton lorry, and a 12-15 H.P. chassis for a light delivery van. Every detail on these machines has been carefully worked out, so that the "steamer" has a good chance of coming to the front. It should be noted that the omnibuses are lighted electrically by the Leitner system, which is provided by Accumulator Industries Limited, 4, White Street, Moorfields, London, E.C. A small dynamo is driven from the engine, and it supplies current for charging a secondary battery of four cells. The dynamo furnishes current at constant pressure irrespective of the speed, and the cells are constantly kept charged. Only when the 'bus is standing are they called upon to any large extent in the way of discharge.



The Darracq-Serpollet Steam Omnibus.

A. Darracq and Company (1905) Limited, Walnut Tree Walk, Kennington Road, London, S.E.—Cabs and delivery vans were the main items at this stand. One of the cabs, which is of the pattern of 250 supplied to the London General Motor Cab Company, seats four persons, and this accommodation has been provided while still complying with the Metropolitan Police requirement that the vehicle must be able to turn round in a street 25 ft. wide. The cab has a two-cylinder 10-12 H.P. engine, and all the mechanism is of the simplest and strongest character. If an engine becomes damaged, it can be removed bodily after unscrewing four bolts, and as all parts are standardised a new engine complete can be at once substituted. The change-speed gear and the differential gear are in one casing, and can be removed and fresh gears put in with the same ease and speed. Another cab has a four-cylinder 14-16 H.P. engine and also seats four

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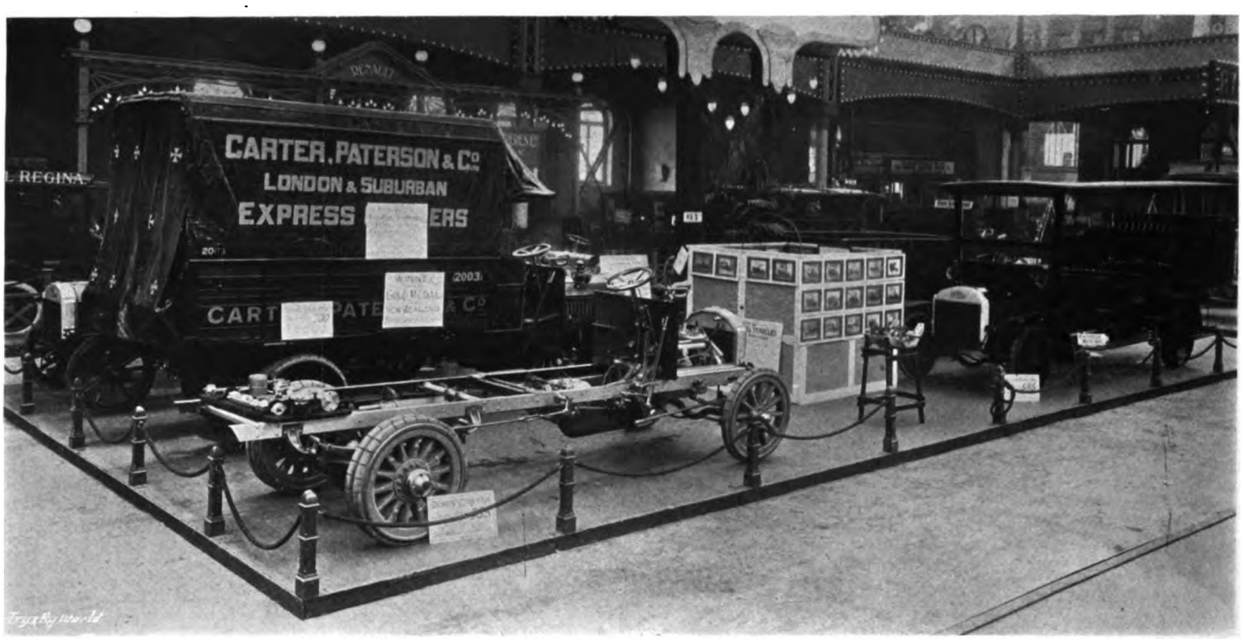
passengers, but it does not comply with the London regulations as to turning in small space. It is of course a larger and more powerful vehicle than the other, and 700 of this pattern have been ordered by the New York Taxicab Company. Two delivery vans with similar chassis were also shown. The 10-12 H.P. van was built to the order of Messrs. John Barker and Son, Kensington, who have spoken very favourably of the results obtained by vans of this type. They have put these vans through some arduous trials and have found the working expenses lower than those of vans of some other makes. This type of van can cover 100 miles a day carrying its full load of one ton, at an average speed of 15 miles an hour. The 14-16 H.P. van is capable of covering 130 miles a day in the usual daily working hours. From reports received from users, it appears that these vans run at a cost for fuel and lubricants of less than ¾d. per mile. With the smaller machine a fuel consumption at the rate of 21 miles to the gallon was obtained. In newspaper delivery work, Messrs. W. H. Smith and Sons have found one of these vans with one driver performs the work formerly done by four horses, two carts, and two men, and the work is completed two hours sooner.

De Dion Bouton (1907) Limited, 10, Great Marlborough Street, London, W.—A number of well-known types of vehicles were shown on this stand, and very little change has been made on the models already in use, the firm claiming that these have proved so satisfactory that change has been found unnecessary. The 30 H.P. omnibus chassis shown was of the type of which about 200 are now running in London. These have proved among the most reliable and noiseless of the various makes in use. The four-cylinder engine drives through a disc clutch consisting of a steel flange on the tail end of the crank shaft gripped between two plates of phosphor-bronze alloy which are connected to the propellor shaft through a cardan joint. It comes up to its work gently. The road wheels are driven through internally toothed rings driven by pinions on the transverse shaft. The gear box and differential are in one aluminium case hung from the sprung portion of the frame by a three-point suspension. One great point of the chassis is the flexibility of the drive. There are four universal joints between the clutch and the gear box, and two more between the differential and the road wheels. A 10 H.P. 2-cylinder cab, built to London police requirements, showed various good points, especially in the matter of lubrication, which only requires attention once a day. The change-speed lever is on the gate system, but the selection is done by a vertical instead of a sideways movement, so that less trouble is involved to the driver and accurate engagement is ensured. A 12-14 H.P. 4-cylinder 2-ton lorry had a carburettor which adjusts itself to variations of temperature so that the most efficient petrol mixture is maintained. To shorten the length of the vehicle the engine is placed under the driver's seat, but accessibility is not sacrificed. Something out of the usual run was an 8 H.P. single-cylinder 1-ton lorry, and a smart brougham for the use of commercial travellers attracted attention, The chassis has a 9 H.P. engine, and the interior of the vehicle is fitted with shelves and drawers. Such a vehicle ought to be of great service, and security against delay from tyre troubles is obtained by the vehicle being supplied with a Stepney wheel. An 8 H.P. hotel omnibus with a sheet-steel body was also on view; it seats six passengers.

Dennis Brothers, Limited, Guildford, had a very varied exhibit, including a 9 H.P. 10-cwt. chassis, a 12 H.P. post office van for Messrs. Macnamara's postal contracts (seventh repeat order), a 20 H.P. 30-cwt. chassis, a 28 H.P. 2-ton polished van chassis, a 28 H.P. 20-seated char-a-banc with canopy, for the Llandudno Motor Garage Company (seventh repeat order), a 35 H.P. 3-ton covered van for Carter, Paterson and Company (ninth repeat order), a 20 H.P. 30-cwt. covered van for Harrod's stores (seventeenth repeat order), and a 40 H.P. 4-ton lorry with hinged sides, for Price and Company, Kieff, Russia. The char-a-banc, which was the only public passenger vehicle on the stand, has engine cylinders of 110 mm. bore by 130 mm. stroke. Forced lubrication is supplied by a pump from the base chamber below the crank shaft. The radiator is of cast-iron, which is much cheaper than the usual more elaborate style. The sides can be taken apart to insert fresh tubes, and the whole is hung from the frame so as to allow of expansion. Another point is that between the clutch and the gear box is fixed a cardan square which allows for any lack of alignment, and

De Dion Bouton Hotel 'Bus.



Dennis Brothers' Stand.

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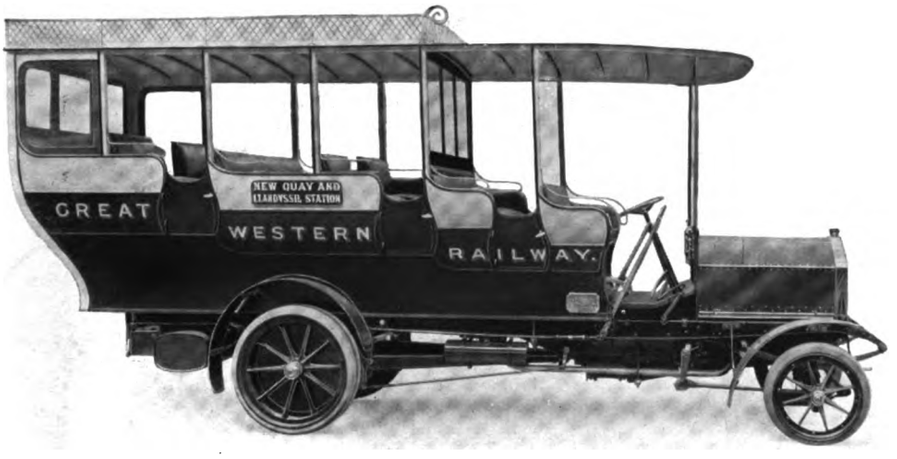
facilitates detachment and attachment. This was the only vehicle in the exhibition with a direct drive on the third speed and gearing up on the fourth. This arrangement is designed to allow of a reduced petrol consumption when running down hill.

Christopher Dodson, Limited, 45, Horseferry Road, Westminster.—This firm of body builders showed a 28 H.P. Milnes-Daimler with single deck railway body, seating 20 passengers, and built to the order of the Great Western Railway, and a 28 H.P. Milnes-Daimler with observation car body, seating 25 passengers, and built for the same railway company. The observation car or char-a-banc we have



C. Dodson's Char-a-Banc to seat 25.

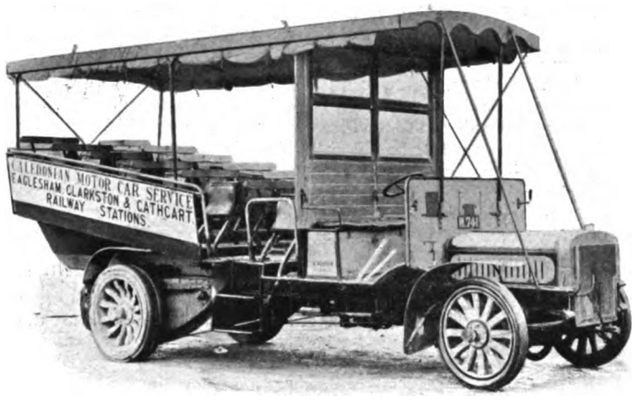
previously described, but the particular vehicle here shown was provided with a cover as shelter from the weather. The railway type of 'bus has longitudinal seats with two cross benches at the front. The roof has a large luggage carrying capacity. The finish of these bodies, both externally and internally, is very good and really approaches the elegance of private coach builders' work. In addition to the vehicles on their own stand the firm were well represented throughout the hall by bodies on machines of various motor manufacturers, the firms having their chassis fitted with Dodson bodies including Greenwood and Batley, the Electric Vehicle Company, Milnes-Daimler, Wolseley, Darracq-Serpollet, etc. The last mentioned 'bus body was one of the finest in the show, and was recently described in our pages.

Drummond Brothers, Limited, Ryde's Hill, Guildford.—This firm had a fine exhibit of machine tools for motor repair work, and indeed for engineering workshops in general. The feature of the stand was a new high-speed all-gear head heavy lathe, designed for repair work in 'bus yards and motor building of all kinds. This tool does an unusually great variety of work, ranging from the heaviest roughing cuts using high-speed steel to the finest class of small work. It is fitted with a new design of traversing boring carriage, has a reversing motion for screw cutting by lever on the apron, so arranged that screws cannot be crossed in cutting, and it has a gap bed of novel form, the saddle having no overhang, even when the gap is in use. The saddle only bears on the lower tier, leaving the upper tier free from wear. There is thus no derangement of the poppet or the tail stock which rests on the upper tier, and the centres are kept true. With the poppet used, however far the barrel is out, there is always the same bearing length. The entire weight of the saddle and the pressure of the tool are taken on the broad surface of the lower tier, and the long narrow guide is underneath, where no cuttings can get at it. The rack pinion is directly under the point of strain. It should also be noted that the saddle has a cross traversing table. This firm have devoted themselves to the production of improved lathes, and both design and workmanship accordingly bear the marks of high specialisation.

Dunlop Rubber Company, Limited, Salford Street, Aston, Birmingham.—This company had a very large display of solid tyres, perhaps the most interesting of which was the hand pattern, which is pressed on to a steel felloe so that it cannot creep.

Durham, Churchill, and Company, Grimesthorpe, Sheffield, had a fine display, including a 24-30 H.P. char-a-banc for 26 passengers, a 20 H.P. 2-ton lorry, a 30 H.P. 3-ton chassis, a 30 H.P. 3-ton lorry for coal delivery, a 2-ton chassis, and examples of their patent "Champion" change-speed gear and friction clutch. The coal lorry presented a variation from the usual type. It is intended for use in London, and, owing to the shortness of some of the weigh-bridges in the metropolis, the wheel-base has had to be brought down to less than 10 ft. This is effected by bringing the back wheels further forward than usual, and placing the differential behind with the chain drive coming forward. Another point of interest was the "Champion" change-speed gear, which is now guaranteed for two years. A sliding rod with a cam is fitted in a hollow shaft, and as the rod is moved along it raises, one at a time, any one of a series of blocks, whose toothed surfaces engage with the internal toothing of different gear wheels. One gear must be disengaged before another comes into action, so that there is no possibility of a driver making a mistake and damaging the gears. The external teeth of the gear wheels are always in mesh with the wheels on the adjoining shaft of the gear. The makers have received many highly satisfactory tributes to the efficiency and economy of their vehicles both for passenger and goods service, and to their freedom from liability to repairs.

Electric Vehicle Company, Limited, 1, Earl Street, Westminster, London. — This company took a distinct place in the show as advocating the use of electric vehicles deriving energy from secondary batteries carried on the car. Among numerous trials of the kind in the past, success financially has never been achieved owing to the cost of maintaining the batteries, but "hope springs eternal" and so forth, and as far as the construction of the machines here shown is concerned a high degree of excellence is attained. The most prominent exhibit was a double-deck 'bus for the London Electrobus Company. That company have had very encouraging results with the small number of machines they have on the road, and they are now having others built by the Electric Vehicle Company. The batteries are maintained by their manufacturers at a contract rate, and so long as there is no increase in that rate, the electrobus has a good chance to pay its way. In the new 'bus now shown there are important changes as compared with the original type owned by the Electrobus Company, which has previously been described in our pages. Instead of a single electric



Durham-Churchill Char-a-Banc.

motor in front with a drive through a reduction gear and a cardan shaft to the back axle, there are two motors mounted on a frame just in front of the back wheels. They drive by chains on to separate countershafts, and other two chains drive on to the back wheels. Each wheel is thus driven separately and the differential gear is abolished. Series-parallel control is provided, and it is possible to run on five different speeds forward and three reverse. The motors are series-wound, but for full speed the fields and armatures are put in parallel with a resistance in the armature circuit. The commutators are of open type, so as to avoid any accumulation of carbon dust from the brushes. Some of these 'buses have Tudor batteries of 44 cells, which enable the vehicle to run 42 miles on one charge, while others have

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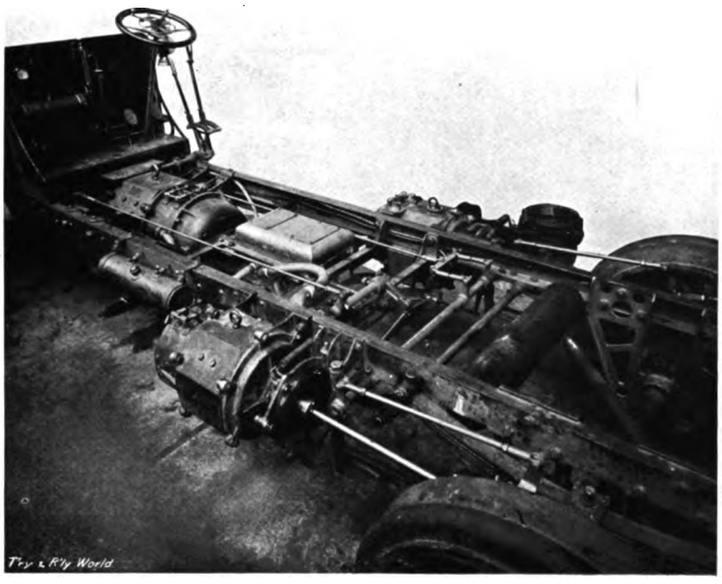
smaller batteries of the Gould type, which run the 'bus 20 miles on a charge. The pressure is about 86 volts. There were also shown a 2-ton electric wagon with two motors, a 1-ton electric delivery van with a single motor and cardan shaft drive, an emergency repair wagon for fire brigade or tramway work, an electric ambulance, and an electric carrier motor tricycle. The 2-ton wagon has been tested up heavy gradients with a 2½-ton load, and has run over 600 miles on demonstration work. The delivery van has been tried over 700 miles.

Fastnut Limited, 60, Aldermanbury, London, E.C.—This company showed specimens of their celebrated fastnut, which has been described in our pages. Before the day of commercial motor vehicles the fastnut was already extensively employed in engineering work of other kinds, and for road cars, which are subjected to so much vibration, it is peculiarly valuable. It was shown on bolts holding bearings with ½ in. play and shafting running at 1,000 r.p.m. The nuts could be removed by hand, yet the fastnut prevented them from coming loose by vibration. It is worthy of note that the Accident Insurance Company, Limited, make a reduction on their premiums on all motor cars fitted with fastnut washers.



Chassis of Hall-Stevens 'Bus.

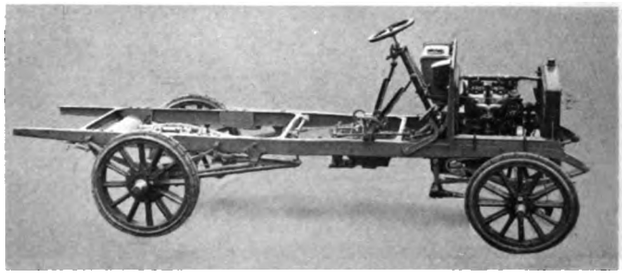
F.I.A.T. Motors, Limited, Long Acre, London, W.C., were exhibiting a 4-ton lorry, a similar chassis with a covered van body, and a 10-14 H.P. cab chassis. The former vehicle, as will be seen by our illustration, was fitted with movable sides, and suitable for the transport of heavy goods, minerals, etc. The chassis is of deep section channel steel, with a 4-cylinder 40 H.P. engine. The cylinders are cast in pairs, each pair being cast with a water jacket. The carburetter is automatic in its action, and is the company's own patent. The petrol and supplementary air ports are controlled by one movement, thus ensuring a correct mixture at all speeds. Ignition is by low-tension magneto. The transmission from the engine is through a multiple disc clutch to the gear box, with which is incorporated the differential; from the differential to the road wheels there is a chain drive. An improved system of forced lubrication is fitted, by means of which a pre-determined quantity of oil is delivered by a pump driven by the engine, thus ensuring a positive supply to all bearings. The leading dimensions are: Bore and stroke of engine, 125 by 150 mm.; length over all, 19 ft. 8 in.; width, 7 ft. 4 in.; wheel-base, 12 ft. 6 in.; length from dashboard to back of frame, 15 ft. 8½ in. The cab chassis was fitted with high-tension magneto, honeycomb radiator, pump, forced lubrication, multiple disc clutch, and live axle drive.

F.I.A.T. 4-Ton Lorry.

The Gaggenau Motor Vehicles Company, 95, Regent Street, London, W., exhibited a 12-14 H.P. 2-cylinder van, designed to carry 15 cwt.; a 28-36 H.P. 4-cylinder single-deck omnibus to carry ten passengers, with accommodation on the roof for a large quantity of luggage; also a 36-45 H.P. six-ton lorry. The omnibus is of the type used in Germany for mail service. From the general appearance of the design and workmanship, it seems probable that more will soon be heard of these vehicles.

J. and E. Hall, Limited, Dartford, Kent.—The principal feature of interest on this stand was the 30-38 H.P. 3-ton Hallford, petrol-electric, omnibus chassis, with transmission gear under the S.B.S. Syndicate and Stevens patents. A great deal of attention was paid by visitors to this exhibit, as the construction of a similar machine was fully described in this and other technical journals in the beginning of this year, and interest was revived by the paper read in March by Messrs. Stevens and Frost-Smith, before the Society of Road Traction Engineers, in which a valuable record was given of the performance of the vehicle of this class now in daily service on London streets in the fleet of Thomas Tilling, Limited. The experience gained by Messrs. Tilling so far indicates that the working expenses, including depreciation, are likely to be about 9¼d. per 'bus mile, or 2¾d. lower than those of their petrol mechanical transmission 'buses. The machine is doing 120 miles a day on the Peckham and Oxford Circus route, and the petrol consumption is equal to a gallon for 5¾ miles, as against a gallon for 5 miles with the ordinary 'bus of the same weight and size. A combination of the best skill has produced the vehicle, as there are the excellent mechanical design, material and workmanship of Messrs. Hall, the electrical knowledge of Mr. W. A. Stevens, the designer of the electrical part, and the practical knowledge of Mr. P. Frost-Smith, chief motor engineer to Messrs. Tilling, who has devoted himself to the practical requirements for street service. It may be recalled that the four-cylinder petrol engine drives a four-pole shunt-wound dynamo, producing a current of 200 amperes at 180 volts. The two motors are mounted longitudinally outside the frame, one on each side, and each drives a road wheel through a shaft and worm reduction gear. Series-parallel control is provided, but owing to the ability to vary the dynamo field strength and to throttle the engine, the motors are almost always run in parallel. A description and drawings appeared in our issue of February 6 last. Messrs. Hall also showed a 30-38 H.P. 4-ton gear-driven lorry chassis, and a 30-38 H.P. 3-ton gear-driven tilt covered van which was awarded a special diploma and gold medal in the last commercial vehicle trials.

Halley's Industrial Motors, Limited, Yoker, Glasgow.—The exhibits shown by this firm included a 16 H.P. 20-cwt. chassis with worm gear, a 20 H.P. fire tender for Clydebank fire brigade, and a 20 H.P. 40-cwt. furniture van. The chief features of these vehicles are accessibility and simplicity, and the two machines which the firm entered in the reliability trials not only gained gold and silver medals, but also the special award for accessibility and simplicity. They also took a high place for freedom from breakdown. All parts of the engines are made interchangeable, and changing can be carried out although the engines are of different powers, as all the wearing parts are of the same size. Interchangeability is also carried out in regard to all possible parts of the chassis. In the lighter vehicles the transmission is by worm gear, and the road wheels are carried on a sleeve



Halley Chassis.

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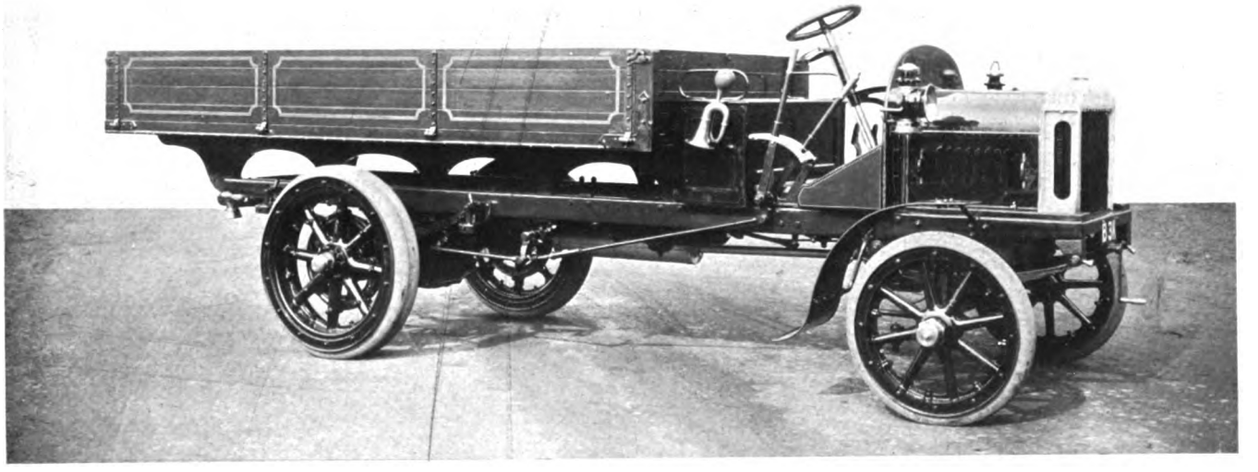
which supports the whole weight, thus relieving the driving axle of all bending stresses. In the heavier vehicles the transmission to the road wheels is by roller chains. Among recent orders was one from J. and P. Coats, the great Paisley thread manufacturers, who, after examining a large number of British and Continental makes ordered 3-ton vans of the Halley type. Other recent sales include a large van for the Crown Agents for the Colonies, and two 28-seated char-a-bancs for Ireland. These were repeat orders.

The K.T. Syndicate Limited, 52, Queen Victoria Street, London, E.C.—This company showed their non-skid tyre, which is designed to carry loads up to 10 tons. This tyre is of peculiar construction, and ought to be very effective. It consists of a flat strip of rubber with two lines of large, hollow projecting knobs, open at the back, and is inserted in a perforated steel rim. The rim is attached to the felloe of the wheel so as to make an air-tight joint under each knob. When the weight comes on each knob, the air in it is compressed, and an effective cushioning action obtained. A tyre of this make was shown which had run 7,000 miles, and still appeared to be in good condition. The K.T. artillery wheel also showed some good features.

Kirkstall Forge Company, Leeds.—Butler's patent channel axle-trees were the specialty shown by this company, and they were indeed much in evidence on many of the motor vehicles in the show. This axle-tree consists of two steel channels separated by distance pieces, and it is possessed of great strength. Other exhibits were crank, axle, and gear stampings, and specimens of best Yorkshire iron and high-grade steel for motor work.

The Lever Spring Suspension and Engineering Syndicate had an exhibit of considerable interest. It consisted of a working mechanical model of a patent appliance for automatically controlling the water level in steam boilers, and a demonstration model showing the action of the lever spring suspension as applied to all classes of motor vehicles. Although of distinct value for all classes of boilers, the water level controlling device was specially designed for use on steam road vehicles. It is claimed that with this apparatus the water level is always maintained at the proper height, the steam pump being automatically operated by the rise and fall of the water. The lever springs are described as forming a patent auxiliary suspension, and are designed to assist the ordinary laminated springs in dealing with the vibration caused by the irregularities of the road surface. By the rapid action of the lever spring suspension the wheels are always in contact with the road, so that the wear on the tyres is very considerably reduced, to say nothing of saving in up-keep in all classes of motor vehicles.

Leyland Motors, Limited, Leyland, Lancashire.—This firm exhibited a 35 H.P., 6-ton, steam wagon with brewers' platform body, being a fourth repeat order for the Rhondda Valley Brewery Company; a 35 H.P., 3-ton, X2 chassis; a 35 H.P. 3-ton standard London 'bus, being one of a repeat order from the London Central Omnibus Company; and an 18 H.P., 30-cwt. to 2-ton lorry with canvas tilt. The X2 chassis is suitable for lorries and omnibuses, and has an improved design of ball bearings throughout. The engine is fitted with forced lubrication, and as the pressure is by gravity it is constant. The oil is pumped from the base chamber to a tank on the dash-board,



Leyland 2-Ton Lorry.

Lacre Motor Car Company, Limited, 1-5, Poland Street, London, W.—The specialty of this firm is box vans for parcels and goods, and four of these were on view, having engines of 16 H.P. and carrying capacities of 24 cwt., 25 cwt., 30 cwt., and 2 tons. These were all built to the order of large firms. There were also a 20 cwt. lorry and a new model of 25 cwt. chassis. The 24 cwt. van is a veteran, having been the first to be supplied to Messrs. Shoolbread and Company. During 2½ years it has run 42,000 miles without an involuntary mechanical stop. During that period repairs and renewals to chassis and body cost £165 18s., and tyre renewals £79 14s. The total of £245 12s. works out at 1½d. per mile. The repairs were rather heavier than on the 30 other vans of the same make which the firm have since purchased, as it was run hard and repairs done at overtime rate. The total working expenses per annum, including 20 per cent. depreciation, average 5d. per mile run. The cost of a pair-horse van displaced, requiring four horses, was about 6½d. per mile run. Taking the average of the first 10 Lacre vans bought by the firm, the working expenses were equal to 4⅔d. per mile, while with 31 vans, displacing 31 horse vans, the mileage run has been increased by 90,000 miles a year. The change speed and differential gears have never required attention. The gears on the van which has run 42,000 miles show little wear. The new chassis show several modifications, such as the introduction of chain cases, which also act as radius rods, and the bringing of the two halves of the countershaft into line so as to permit of chains of equal length. The Lacre Company are now undertaking to maintain their vans at fixed contract rates.

and the consumption is less than a quart per day of 100 miles. Regarding the steering, the pivot is inside the centre of the wheel, and works on ball bearings. The change-speed lever is now fitted with a gate change. The universal joints between the gear box and the clutch are closed in with aluminium covers, and they run in oil. The brakes are in the centres of the back wheels, so that in braking there is no gear to work through, and this is an advantage, because sometimes more harm is done to gears through sudden braking than through driving. The hand brake is on a smaller drum inside the other, and the brakes are accessible and easy of adjustment. These points refer for the most part also to the other petrol chassis. The firm have a contract with the London Central Omnibus Company to maintain and keep in repair the Leyland omnibuses which that company have in use. In one week recently the Leyland 'buses of the Central Company made 99½ per cent. of the possible mileage, and this was done by vehicles which have been running for a year and a half. The number of these 'buses at present is 15, and the company do not use any other make. The Leyland firm were well known for their steam wagons before they took up the petrol motor business, and they continue to do a large trade in steam wagons and lorries.

J. Liversidge and Son, Limited, 196, Old Street, London, E.C., and 561, Old Kent Road, London, S.E., the well-known body builders, had a most interesting exhibit, which included one of the Darracq-Serpollet single-deck omnibuses built for the Chota-Nagpur Motor Company, particulars of which were given in our issue of

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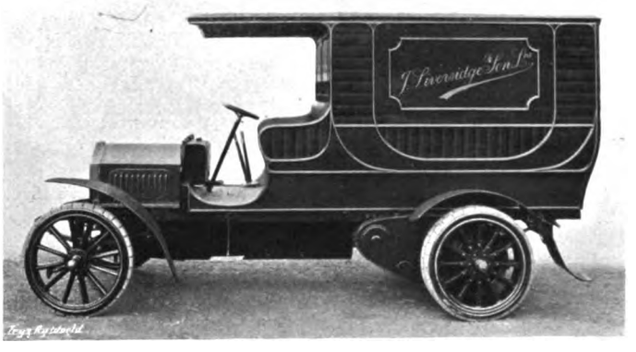
April 2. A Straker-Squire 40 H.P. chassis was fitted with a single-deck omnibus body, designed as an improvement on the present double-deck omnibus in London. The seats are arranged on somewhat similar lines to those of the cars of the underground electric railways, giving passengers a better view of the roads than in the present method of seating. A Lacre 1-ton chassis, fitted with box van body suitable for drapers, house furnishers, or West End traders

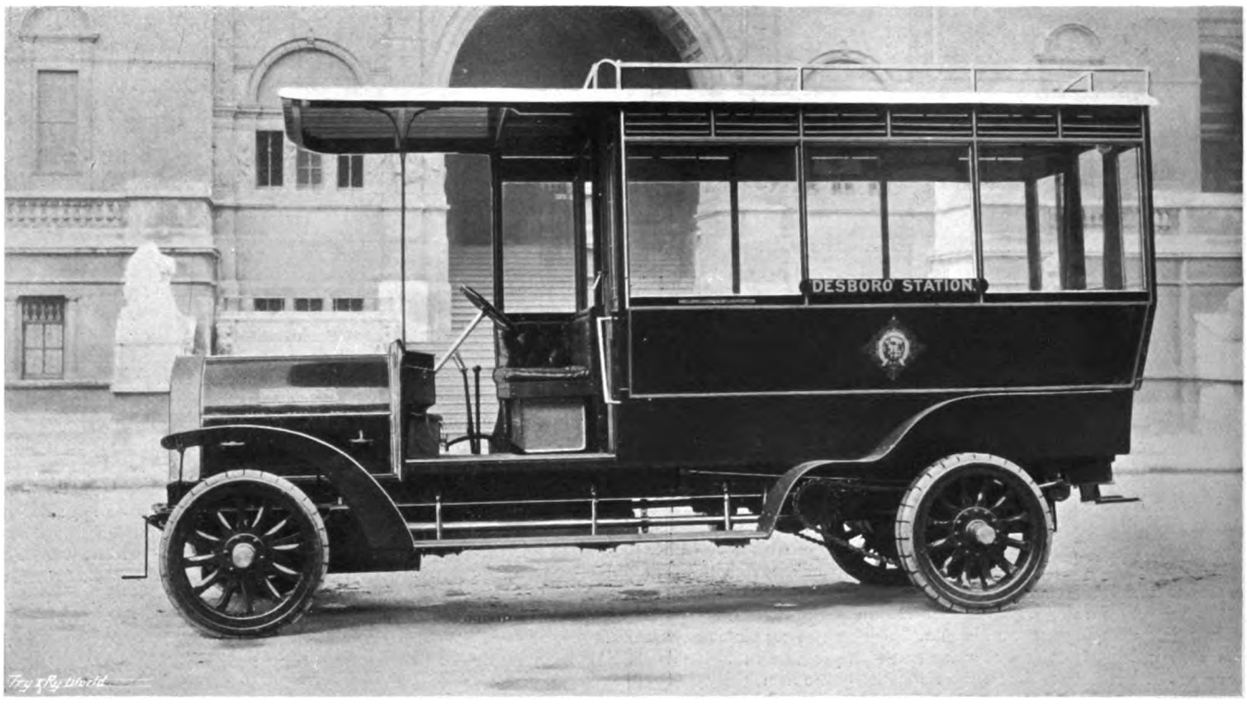


Liversidge Van.

requiring a smart body which would be a good advertisement, was also shown. Special attention had been given to the floor space and inside fittings, so that different classes of goods could be carried and easy access given to each. The front was fitted with sliding doors, and the back with doors opening outwards. They had the Osborne patent slam lock, which holds the doors perfectly tight, eliminating noise and rattle There was also a Lacre 25 cwt. chassis fitted with box van body suitable for advertising purposes. The body is built on graceful lines, and so panelled and painted as to show up the writing and advertising matter on it. Messrs. Liversidge further exhibited the De Nevers grooved solid tyres, suitable for all classes of commercial vehicles. These tyres are more resilient than the ordinary solid tyre, as the full resiliency of the rubber is obtained, while it is claimed that their grooved construction effectually prevents skidding. The Scott non-skid tread was another exhibit. This is for pneumatic tyres suitable for light commercial vehicles. It consists of a series of alternate rubber and steel studs. The rubber studs are higher than the steel ones, and absorb the first shock. The treads can be fitted to any make of cover. The patent radial centre-lock wheel shown by the same firm is constructed with a segmental centre, which has the effect of holding the spokes firmly wedged so that they cannot become loose. Greater strength is given to the wheel, and in consequence the substance of the spokes can be reduced. The wheel also is more resilient owing to the feet of the spokes being so firmly held that the full spring of the timber is obtained. Repairs can also be much more easily effected, as the segments can be removed and damaged spokes taken out, new ones fixed, and the segments replaced without disturbing the tyre or rim. Messrs. Liversidge had a further exhibit on stand No. 202. This included the Allen front wheel brake, and the Osborne patent lock. The brakes are applied to the front wheels, and are perfectly compensated, so that they do not interfere with the steering. The advantages of front wheel braking is that when the brakes are applied the weight is thrown forward on to the front wheels, and the car does not tend to swing round as it does on the application of the back wheel brake. The Osborne lock is designed for the doors of motor vehicles, which, being subject to excessive vibration, tend to work loose and cause trouble and noise. The lock is so arranged that the doors are firmly held in position, and no vibration can disturb them. The following is a list of the vehicles exhibited on the various stands, the bodies of which were built by Messrs. Liversidge: On Messrs. Straker and Squire's stand, a heavy wagon body, char-a-banc body, and a cab body; on the Lacre Company's stand, three van bodies of different designs; on the Darracq-Serpollet stand, a van body; on the Wolseley Company's stand, a double-deck omnibus: on Commercial Cars, Limited, stand, a box van; and on Durham-Churchill's stand, a van body.

Lodge Brothers and Company, 14, New Street, Birmingham.—Ignition arrangements invented by Sir Oliver Lodge were the feature at this stand. These devices, which are so favourably known, comprise ignition apparatus for motor boat engines, high-speed multi-cylinder engines, and slower running engines. The sparking plugs shown retain their power of sparking even when immersed in water.

Maudslay Motor Company (1907), Limited, Parkside, Coventry, and 60, Piccadilly, London, W.—Two interesting vehicles were shown by this company, one a 30 H.P., 12-passenger, single-deck 'bus, built for the Midland Railway Company, and the other a 40 H.P., 3-ton heavy lorry, being the actual vehicle which competed in the commercial vehicle trials and gained a gold medal for general excellence and a War Office diploma for accessibility of engine. The omnibus is of a new type, and is 18 ft. long, 5 ft. 9 in. wide, and has a wheel-base of 12 ft. 3 in. The frame is of channel steel, and a casing from the



Maudslay Railway Omnibus.

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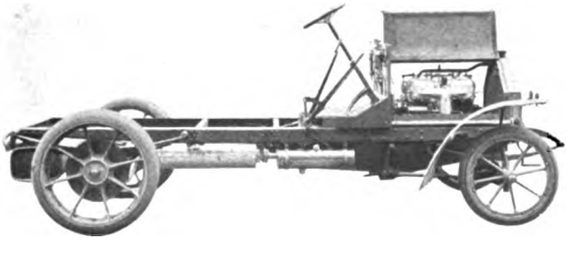
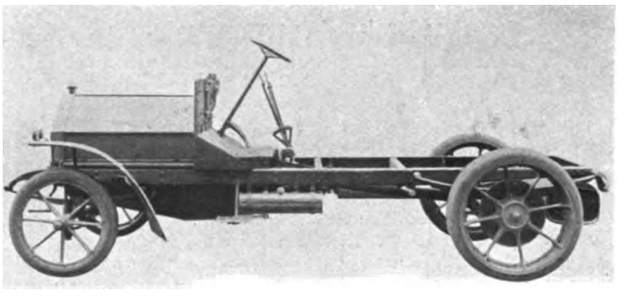
front of the engine to the back of the gear box protects the mechanism from road dirt. The engine has four cylinders of 4½ in. bore with 5 in. stroke, and all its bearings are of phosphor bronze lined with white metal. A great feature of the whole design is accessibility. A good system of forced lubrication is employed throughout. The entrances to the 'bus are at the sides close to the driver's seat, and the finish of the body is in bright ruby. The 'bus will run between Desborough and Rothwell. The lorry which obtained the honours at the trials has been fifteen months on the road and has run 6,000 miles. During that period not a pound has been spent on repairs. The engine has four 5 in. cylinders with a 5 in. stroke, and runs at 750 revolutions per minute. The water and oil pumps are driven from the crank shaft. The four speeds provided range from 3·4 to 12·5 miles per hour. Accessibility and durability may be regarded as the special attributes of the whole machine.

Milnes-Daimler, Limited, Tottenham Court Road, London, W.—Several fine vehicles were shown by this firm. A 35 H.P., 5-ton chassis, suitable for a heavy lorry, presented a number of new features. In one piece with the pressed steel frame are steel aprons on each side, which support the gear box and the engine. The cylinders of the latter are of 120 mm. bore by 150 mm. stroke, giving 35 H.P. at 800 r.p.m. The engine, like the gear box, is supported on a three-point suspension. The ignition is of a new type, as, instead of having the sparking lever fixed to the plug, it is now internal. The base chamber is of aluminium, and lubrication is by forced feed. The patent carburetter is adaptable for alcohol, benzol, paraffin, and petrol. The adjustment is carried out by regulating the air supply. The gear box has pivoted trunnions at the front end on either side, and a large centre bearing fitted into the spectacle cross member at the back end. The differential is now carried through the steel perch-bars, instead of resting on the top of them as before. There are three independent sets of brakes. The metal-to-metal clutch has an aluminium coning, and works internally, instead of externally as before. A universal joint has been adopted on the shaft behind the gear box, and the transmission is thus by cardan shaft to the universal joint, and by the differential cross shaft direct on to the internal gears on the driving wheels. These features apply more or less to the other chassis exhibited by the company. The other machines included a 28 H.P. omnibus built for the Great Western Railway Company, a 22 H.P., 2-ton box van, which obtained a gold medal in the reliability trials, a tip wagon, suitable for a municipal cleansing department, and an 18 H.P. chassis with a body for post office service.

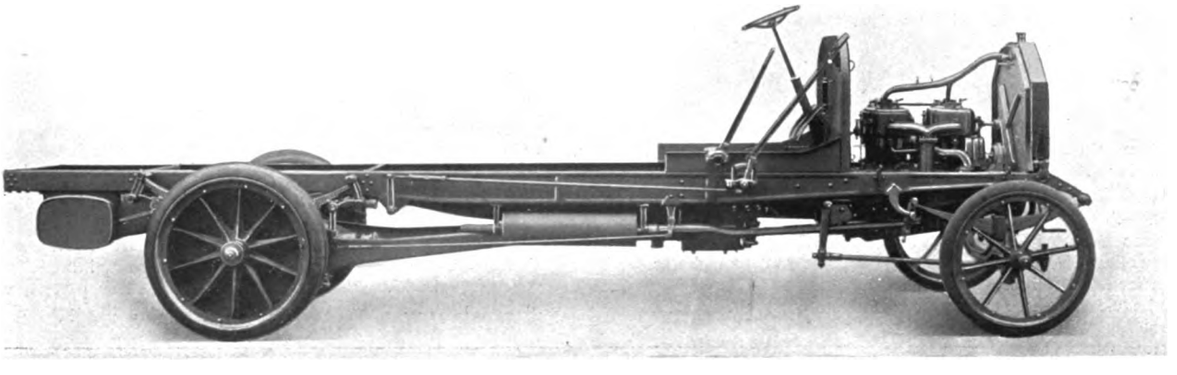


Milnes-Daimler 2-ton Chassis.

The New Arrol-Johnston Car Company, Limited, Underwood, Paisley. This firm exhibited six machines as follow: 24-30-H.P. 'bus chassis (standard), complete in every respect according to the Metropolitan Police regulations; 3-ton brewer's dray; 1-ton delivery van; 30-cwt. furniture removing van, built for Messrs. Bannister's, of Blackpool; 20-seated char-a-banc; and 15-seated wagonette. In addition, they showed two models of the Arrol-Johnston detachable wheels for commercial vehicle work. The brewer's dray is fitted with a four-cylinder 24-30-H.P. motor, and has all the well-known Arrol-Johnston features, such as the enclosed chain case and spring drive, automatic force feed lubrication, etc. All Arrol-Johnston commercial vehicles are fitted with automatic forced feed pump lubrication, and all are guaranteed for 12 months against defects or bad workmanship.



Milnes-Daimler 1-ton Chassis.



Milnes-Daimler New Type 5-ton Chassis.

North British Rubber Company, Limited, Castle Mills, Edinburgh.—This old-established company, who, it may be recalled, were the inventors of the detachable pneumatic tyre, showed a wide variety of their clincher tyres, both solid and pneumatic, for motor vehicles. In a new type the tyre is compressed in the process of manufacture and forced into position in the rim. Another form is the clincher Ducasble, which is a cushion tyre with one or two steel channels running through the centre. A number of T-bolts pass from the channel through the rim. Separate rubber blocks, vulcanised to a steel base, and held in position by frames bolted to the rim, are the feature of the clincher block tyre. Any block becoming faulty can be taken out and a fresh one inserted.

Polack Tyre Company, 31-34, Basinghall Street, London, E.C.—A large number of the ordinary solid and pneumatic tyres were shown by this firm, but their novelty was a non-skid tyre. One form of this is triple, the two outside tyres being of hard rubber, while the centre one is of soft red rubber and stands a little higher than the other two. A firm grip of the road is ensured, and the tyre can be fitted to existing rims. The principle is also applied to block tyres, the soft blocks standing a little higher than the hard ones. On the pneumatic tyre, alternate lines of soft and hard studs are vulcanised into the cover. Not the least interesting exhibit on this stand was a collection of tyres

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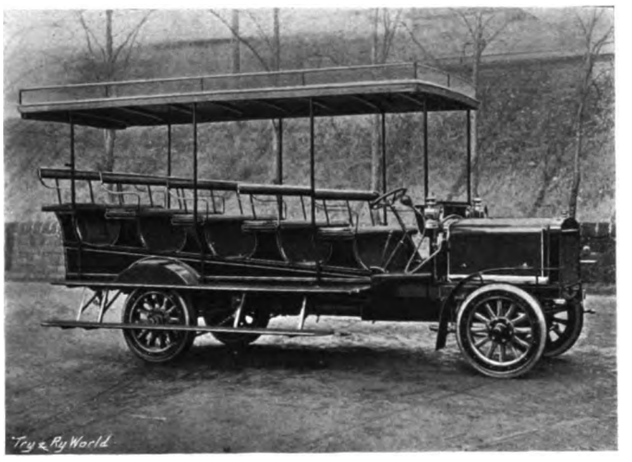
recently taken from service on London omnibuses. For the purpose of identification each tyre manufactured by the Polack Company has a distinctive number, and as each wheel also has its number the actual record of the running of the tyres can easily be taken. Each of the old tyres exhibited had its record attached, and among them was a back tyre from the London Road Car Company replaced after running 23,867 miles. Another came from the Vanguard Motor 'Bus Company after 24,786½ miles, and a third from the London General Omnibus Company after 37,543½ miles. We were assured that the collection



New Arrol-Johnston Char-a-Banc.

exhibited was by no means an exceptional one, but taken from those most recently replaced. The following, in addition to the companies mentioned above, are among the present users of this make of tyre: the Great Western Railway, the London and North Western Railway, the Lancashire and Yorkshire Railway, the North Eastern Railway, Cambrian Railways, the Bath Electric Tramways Company, the Metropolitan Electric Tramways, Limited, the London Electrobus Company, the Cardiff Corporation, Milnes-Daimler, Limited, etc.

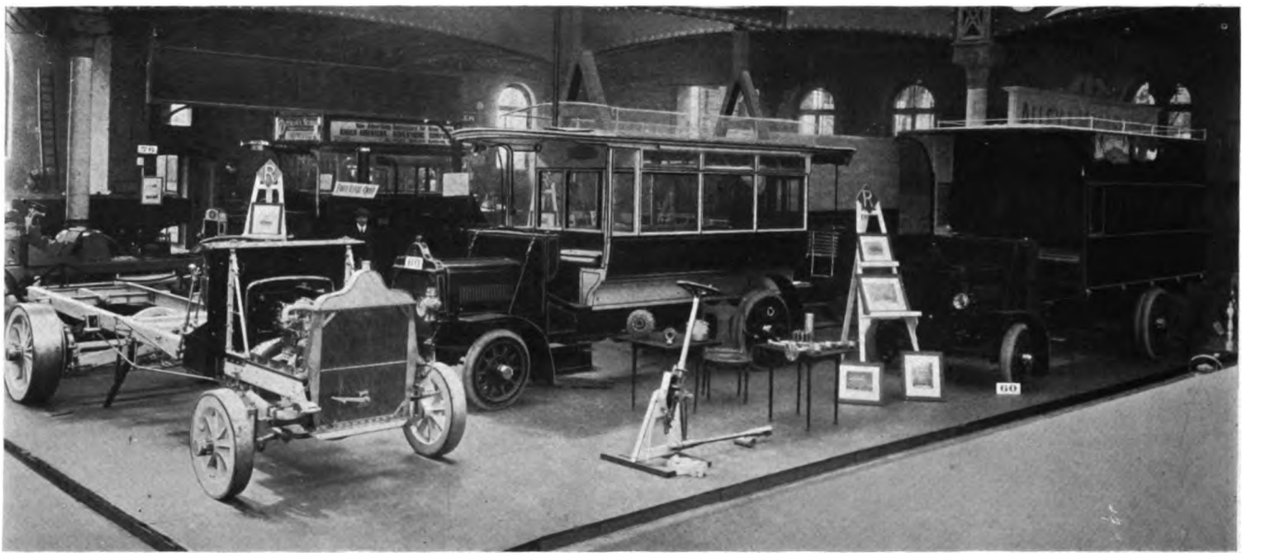
Hans Renold Limited, Progress Works, Manchester.—This famous firm of chain makers showed a great range of chains, both as to pattern and weight, block, roller and silent chains being included. The heaviest of these chains has a breaking load of 86,000 lb.

our pages, but some modifications fall to be noted. The Simms-Bosch low-tension ignition has been substituted for the Eisemann high-tension magneto, but the latter can be fitted if ordered. The ignition plug is now capable of being removed in a moment. The whole gear of the magneto is self-contained, and needs no fixing on the cylinders. The water pipe of the radiator has a flexible metallic hose coupling. The engine, which is fitted to work either with petrol or paraffin, is started on petrol. The change to paraffin is effected by a handle in front of the driver which throws the petrol carburetter out and the paraffin one into action. The paraffin carburetter is heated to begin with by the petrol exhaust. The gear-box is capable of very easy removal. It may be briefly recalled that the omnibus chassis has four cylinders, 5⅛ in. in diameter by 6 in. stroke, with an ordinary speed of 850 revolutions per minute. The connecting rods and crank shaft are of nickel steel, the crank chamber of aluminium, and the engine bearings of phosphor bronze. The transmission is through a differential shaft, and thence by internal gear wheels to the road wheels, the drive being taken up by the patent triangular underframe and spring drive. The details of the lorry chassis are similar. The company have issued tables of running costs of their vehicles based on experience, and these work out, including 20 per cent. depreciation and interest on capital, as follows, per mile run: 3-ton van, 9d.; 5-ton lorry, 1s.; double-deck omnibus, 8¼d.

Safety Non-Explosive Reservoir Company, Limited, 62, Frith Street, Shaftesbury Avenue, London, W.—This German invention, which has previously been described in our pages, is now being worked in this country by the above company, who showed a number of vessels for storing and carrying petrol and other inflammable liquids. The Snercold safety device, as it is called, consists essentially of each opening in the tank, or other vessel, being fitted with an inwardly projecting perforated metal tube, which is covered by a sleeve of wire gauze. This Davy-lamp arrangement is a sure prevention of explosion, and it has come successfully through the tests of the British Fire Prevention Committee. In Germany and Austria the use of this device is compulsory.

Shrewsbury and Challiner Tyre Company, Limited, Kay Street, Ardwick, Manchester, and Westminster.—A wide selection of these celebrated tyres were on view. Their "world" tyre is of the twin solid type vulcanised to a steel base and held in position by flanges, while the "giant" tyre is of the single type. Some very strong wheels with Challiner's interlocking spokes were shown.

Smith, Parfrey, and Company, Limited, Rannoch Street, Fulham Palace Road, London, W.—This firm maintained their reputation for wheels by the large exhibit of artillery pattern wheels for both light and heavy motor vehicles. Among the types shown were



Ryknield Stand.

Ryknield Motor Company, Limited, Burton-on-Trent.—This firm showed a 40-50-H.P. 5-ton polished chassis, a similar powered 22-seated single-deck 'bus, to seat 16, including 6 in a smokers' compartment at the rear; a 3-ton furniture van, and a 3-ton lorry, each of 40-50-H.P. These massive chassis have already been described in

those now largely in use for motor omnibuses. Axles, shafts, gears, and forgings for various parts of motor cars were shown, and throughout there was evidence alike of good material, design, and workmanship.

Smith's Flexible Hub, Limited, 20, Copthall Avenue, London, E.C.—The main feature of the wheels shown by this firm is that a

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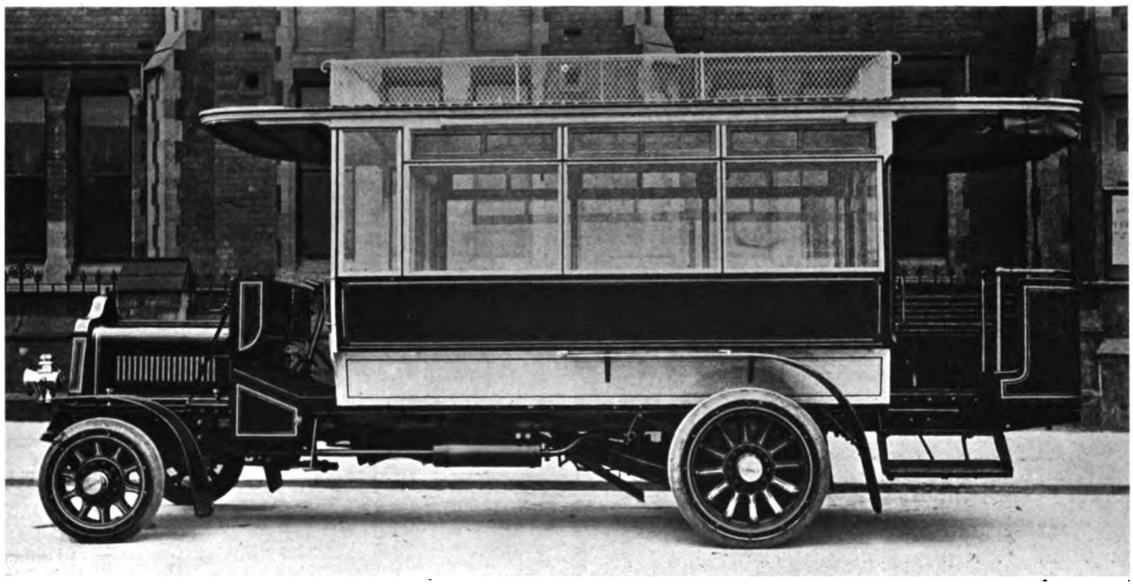
flexible drive is transmitted through the agency of rubber-covered spindles or distance pieces, which are located in chambers formed in the rigid body of the wheel, and connect together sideplates which cover the ends of the hub, the object being to provide a hub of comparatively simple construction wherein the shocks due to the vehicles passing over inequalities of the road are more readily absorbed by the flexible cushions in an approved manner, so that the give and return of the cushions is unaccompanied by any jar, and a positive, although at the same time, flexible drive is obtained. Furthermore, means are provided whereby internal friction in this hub is reduced to a minimum.



Ryknield Single-Deck 'Bus.

D. Stewart and Company (1902) Limited, London Road, Glasgow.—This firm showed a 45 H.P. 5-ton Stewart-Thornycroft steam wagon with end-tip box body. This vehicle is a repeat order

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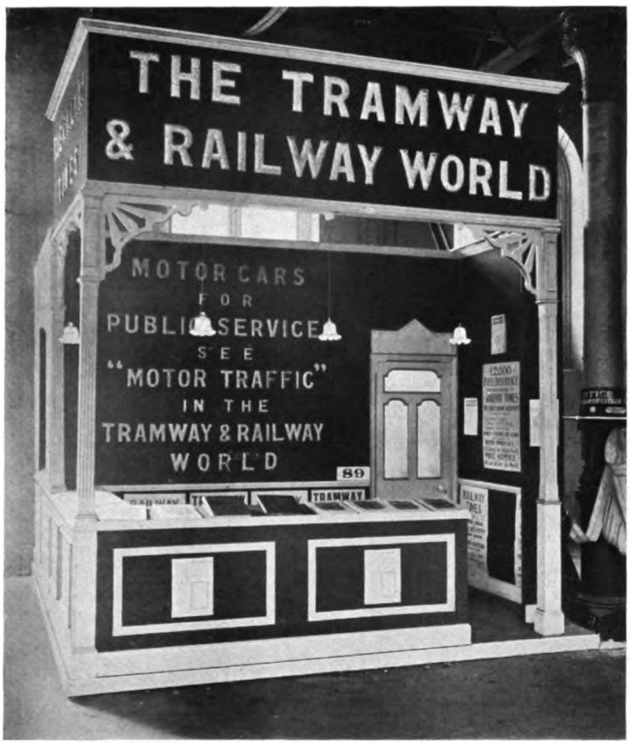
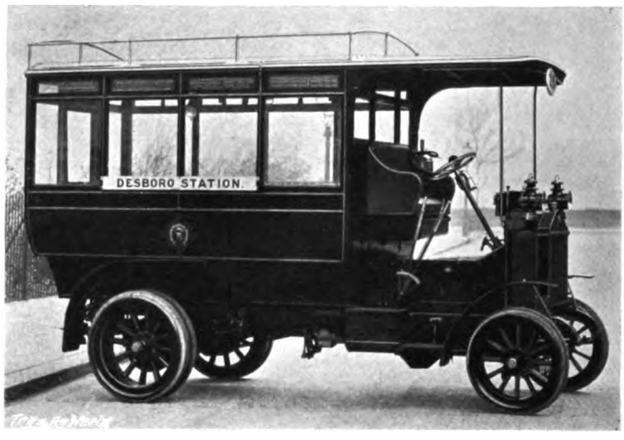
from Smethwick Town Council. Messrs. Thornycroft have stopped the manufacture of steam wagons and turned themselves to the petrol vehicle, but Messrs. Stewart are continuing the production under license as regards the well-known patent driving gear. The Glasgow firm have done away with the water-tube boiler and introduced one of the locomotive type, and have substituted D slide valves for piston valves. A horizontal compound engine is used, carried below the main framing, with the crank shaft parallel to and about two feet in front of the rear wheels axle. The cylinders are respectively 7 in. and 4½ in. in diameter, with a 7 in. stroke. The boiler, which is in front of the driver, has a heating surface of about 50 square feet, and either coal or coke can be used as fuel. The steam pressure is 200 lb. per square inch. The water tank, holding 180 gallons, is carried under the rear of the main frame, and contains enough water for 15 to 20 miles' running. The transmission from the engine to the road wheels is by the Thornycroft patent spur gearing which allows for vibration from the road. The long record of successful work by this type of wagon appears likely to be improved upon.

Societa Anonima Cantieri Gallinari, Leghorn, Italy.—This company, otherwise described as the Gallinari Naval Construction Company, have recently developed a branch for the construction of heavy automobiles, and for business in this country Mr. Orlando Sumner, consulting engineer, 39, Victoria Street, Westminster, has been appointed agent. The exhibit introducing the work of the company to British commercial motor users consisted of one single chassis, but it was of such a nature as to demand the close attention of every visitor. The company have had a prolonged experience of naval construction and marine engineering, and for the manufacture of commercial motor vehicles they have started extensive works at Leghorn. The principles of marine engineering seem, as far as possible, to have been applied. The whole chassis is of exceptionally massive design, and is intended for a load of from five to six tons. It is thus suitable either for a double-deck 'bus or for a lorry. The engine has exceptionally large working parts, and at a speed of only 600 r.p.m. develops



Our Stand at Olympia.

40 H.P. The slow speed of revolution must materially reduce wear. Another important feature is that when it is desired to haul a trailer the speed of the engine can, by adjusting the governor, be raised to 1,000 r.p.m., giving 75 H.P., and the whole chassis is designed to stand the stresses arising from the development of that power. The engine has four cylinders, each 5¾ in. in diameter, with a 6½ in. stroke, and the consumption of petrol is guaranteed not to exceed ·68 of a pint per horse-power-hour. Transmission is by cardan shaft and differential gear on the back axle, both shaft and gear being completely enclosed. The rear axle is in one solid piece and inert. Each road wheel is carried on a sleeve which revolves on the axle, and these sleeves terminate in gear wheels on each side of the differential. The sleeves, and thus the road wheels also, are driven through a short counter-shaft by the differential gear. By this arrangement there is a dead axle of great strength, with neither live counter-shaft nor driving chains. The steering gear is of an entirely new type. It consists of a worm and sector carried outside the frame and mounted directly over the offside steering pivot, which it actuates direct. The worm is



Wolseley Station 'Bus.

operated through universal joints from the steering column, and a distance rod communicates the motion to the other front wheel. It is claimed that with this arrangement there can be no back lash. The road wheels are of cast steel, and arranged to take either rubber or iron tyres as required. The radiator is packed on leather, and is held secure by a brass and leather strap. Ball bearings are used everywhere. The chief engineer inspecting officers of the British War Office are having trials made of this noteworthy chassis.

John I. Thornycroft and Company, Limited, 2, Albemarle Street, Piccadilly, London, W.—Some fine specimens of the well-known Thornycroft machines were on view, including a 16 H.P., 30-cwt. box van, with 2-cylinder engine and thermo-syphon cooling system; a 30 H.P., 29-passenger char-a-banc with 4-cylinder engine; a 30 H.P., 16-passenger, single-deck 'bus with 4-cylinder engine, built for the London and South Western Railway; and a 24½ H.P., 4-cylinder, 3½-ton tilt van, to run on paraffin. The first-mentioned is the most recent of the firm's productions and is sold at the low price of £395, and the specimen on view was sold to the Kennedy Motor Company, Glasgow. In the case of the tilt van the starting is done on petrol, and the exhaust is sent through the paraffin vapouriser till it is heated sufficiently to begin work. The driver turns off the petrol supply and turns on the paraffin by a two-way tap on the dash-board. The machine on view was for the Southern Nigeria Government, and was fitted with a canopy extension over the driver's seat for protection from the sun. It is a similar machine to that which was awarded the gold medal and the Army Council diploma at the commercial vehicle trials for running on paraffin. The whole of the vehicles shown had forced lubrication and side chain transmission, and were the result of the most careful consideration of every detail.

Wolseley Tool and Motor Car Company, Limited, York Street, Westminster, and 76, Deansgate, Manchester.—Among the numerous Siddeley types made by this company, they exhibited an 18 H.P., 30 cwt. chassis, an 18 cwt. single-deck omnibus to seat 14 persons, built for the Midland Railway Company, a 10 H.P. 10-cwt., box van, a 10 H.P. cab chassis, two 10 H.P. cabs, and a 10-12 H.P. cab for private use. In the first of these the engine is under the driver, so as to allow of a good length of body without increasing the length over all, and without undue overhang. The chassis is the same as that used for the railway 'bus shown. A double reduction live axle with differential gear is used, and external brakes of large diameter are fitted. The radiator has a tank above and below, with vertical tubes, and the whole can be easily taken to pieces for repair. Vickers' steel forgings are used for all working shafts, etc. The various cabs shown were interesting. The chassis is built to conform to the London police regulations. The frame is of pressed steel, curved up over the rear axle and dropped for the door. The two-cylinder engine runs at 1,000 r.p.m. The

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lubrication is automatic, the big ends being lubricated by splash, and the level in the crank chamber is kept constant, there being an overflow into a sump. From the sump the oil is drawn up, filtered and sent back to the crank chamber. The engine, carburetter, magneto, oil pump, fly-wheel, and clutch are arranged so that they are readily removable as a single unit. The top speed of the cab is 19½ miles an hour. The cab designed for private use is suitable for a job master, or a commercial traveller, or a doctor. It is better finished than the public cab, and upholstered in a superior style at an extra cost of £20.

MR. H. G. BURFORD.

Mr. H. G. Burford, M.Inst.Mech.E., the chairman of the Commercial Vehicle Committee of the Society of Motor Manufacturers and Traders, who is leaving London on a tour round the world, may justly claim to be one of the pioneers of the motor vehicle industry. Born in 1867, he began his engineering career at the Parrett Iron Works, Martock, Somerset, where he served his apprenticeship. Immediately after leaving Somerset he joined Colonel Crompton at Chelmsford, and so began an association which was destined to have a very considerable influence upon the trade. As at this time Mr. Burford was intent on obtaining the widest possible experience, he stayed but a comparatively short time with each of the following firms: Messrs. Davey Paxman, Colchester; the Royal Arms Factory at Enfield: and the Liquid Fuel Engineering Company, of Teddington and Cowes (where he had charge of the testing and experimental departments). He then founded the firm of H. G. Burford and Company, of Teddington, which was later changed to Burford, Van Toll, and Company. As manufacturers of the New Orleans car Messrs. Burford and Van Toll took an active part in the 1,000 miles reliability trials organised by the Royal Automobile Club, and obtained the gold medal in England, and the bronze medal in France. In 1901 Mr. Burford joined Mr. G. F. Milnes, the well-known tramcar builder, of Birkenhead and Hadley, and founded a motor vehicle department at Balderton Street, London, W. At the trials which were organised by the Liverpool Self-propelled Traffic Association in 1902, the vehicle entered by Mr. Burford was awarded the coveted gold medal, and at the Glasgow trials, which were held the following year, Mr. Burford again secured the gold medal. Upon the formation of the firm of Milnes-Daimler, Limited, Mr. Burford was appointed manager, and it is largely due to his special efforts to produce a reliable motor vehicle, suitable for public service, that the Milnes-Daimler 'bus is in use in all parts of the world, while about one-third of the total number of motor omnibuses now running in London were manufactured by that firm. Mr. Burford has since been appointed managing director.

THE BRISTOL TRAMWAYS AND CARRIAGE COMPANY have made an addition to their services by running motor omnibuses between Eastville tramway terminus and Frenchay.

HALLEY'S INDUSTRIAL MOTORS LIMITED have appointed Messrs. G. H. Grapes and Company to be their agents for the sale of Halley public service and industrial motor vehicles in New Zealand.

MOTOR POSTAL SERVICE.—The use of motor vans for postal service continues to extend, a recent example being an order by the Post Office to Sturmey Motors Limited for a 15 cwt., 12-18 H.P. van for parcel post work between Leeds and Bradford.

ELECTROBUS PROMOTION.

In the end of April, the London Electrobus Company, Limited, issued a prospectus inviting subscriptions for 240,000 ordinary shares of £1 each and 12,000 deferred shares of 5s. each. The prospectus was accompanied by an illustrated supplement extolling the electric omnibus, giving some results of the company's experience with the limited number of 'buses which they have up till now been running, and describing the garage and charging station.

The prospectus itself states that the whole of the issue will be devoted to the purposes of working capital, less the cost of the issue. After the ordinary shares receive a dividend of 10 per cent. in each year any available balance of profit will be divided, half among the ordinary, and half among the deferred shares. The former have priority as to capital. The directors claim that the results of nine months' running with a small fleet of electrobuses show that the electric omnibus must replace the "oil-fed" motor omnibus on the streets of London The well-known advantages of electric working are set out, and to the nuisance associated with the petrol 'bus, prominence is duly given. The demand for a vehicle free from the objectionable features, it is claimed, is met by the electrobus, and the directors predict that the general adoption of this class of vehicle will solve the surface passenger traffic problem of London. The present issue of capital will be used to increase the number of electrobuses, and to provide additional garage accommodation. Contracts for the supply of 125 vehicles and for the maintenance of tyres and accumulators have been entered into. The actual running figures for the nine months ended April 14 last are quoted: Passengers, 970,271; miles run, 93,482; takings per car mile, 13·069d. The working expenses are not given, but an estimate of 9½d. per car mile by Sir Douglas Fox and Partners is mentioned instead. Battery maintenance is carried out by contract for 2d. per car mile. The consumption of current has been slightly reduced by an improvement in the type of chassis, and is now 1·264 units per car mile. For the increased number of 'buses to be run energy is expected to be got for ·4 of a penny per unit. The directors estimate that, with 150 'buses running 80 miles per day on 300 days per year, the net profit, after paying all expenses and depreciation allowance, will be 3d. per car mile or £300 per omnibus per annum. This is equal to £45,000, while only £30,000 is required to pay 10 per cent. on the whole of the ordinary share capital. The part of the balance for the deferred shares is equal to 100 per cent. on them. The right to apply for one deferred share is given to every applicant for 20 ordinary shares.

Sir Douglas Fox and Partners, consulting engineers, writing to the directors on April 16 last, say that from the report they have sent to the directors containing full details of the whole of their trials and examination of the electrobus and garage equipment, it will be seen that they estimate the working costs for 100 electrobuses at from 9d. to 9½d. per car mile. This figure they have arrived at after allowing liberally for maintainance, renewals, and depreciation. They consider it safe to estimate an annual mileage of 24,000 miles per 'bus, or 80 miles per day for 300 days per year.

We may remark that the one great point of doubt in the whole alluring picture is whether the manufacturers of the storage batteries will continue to be able to contract for maintenance at 2d. per car mile. So long as that can be done the prospects are fair enough. But it was on that rock that all previous projects of the sort split, and no revolution has been effected in storage batteries since the time of previous financial failures.

A LONG ELECTROBUS RUN.

On Easter Sunday an electric omnibus, supplied by the Electric Vehicle Company for the Brighton and Hove Omnibus Company, left London for Brighton, and accomplished the journey of 52 miles on one charge of the secondary battery. There were several delays, but these had nothing to do with the battery, and the run is the longest which has been accomplished by an electric omnibus on one charge. The vehicle is similar to those now being run in London by the Electrobus Company, and a description will be found in our notes on the recent industrial motor vehicle show. On this particular run, the current consumption for a speed of 12 miles an hour on a good level road was about 85 amperes at 95 volts. On hills, with the motors in series, the speed dropped off to five or six miles an hour, and on very steep inclines to under three, the consumption varying between 100 and 125 amperes. On Redhill the maximum current taken was 130 amperes, but on the long pull up to Handcross, and again to Piecombe, 200 and even 250 amperes were registered momentarily. The 'bus was a few days later started on its regular service in Brighton.

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MOTOR TRAFFIC NOTES.

THE LIVERPOOL AND MANCHESTER DISTRICT MOTOR CAB COMPANY, LIMITED, has been registered with a capital of £100,000 to adopt an agreement with J. A. Lawton and Company, Limited, Liverpool, the Liverpool Motor Cab Company, Limited, and the Manchester Motor Cab Company, Limited, and to carry on a motor cab undertaking.

ALCOHOL FUEL IN AMERICA.—According to a report by the United States Department of Agriculture, favourable results have been obtained from experiments with alcohol as fuel for internal combustion engines. The engines ran more quietly, developed more horse-power, and a much higher compression could be obtained with safety than when petrol was used. The combustion in the cylinder seemed to be of a less explosive character than that of petrol.

SIGHT-SEEING CARS FOR LONDON.—Developing an experiment made last year by the Great Western Railway Company and Motor Jobmasters, Limited, Mr. W. E. Sebree has brought over from the United States three electric char-a-bancs, which are to be run for the benefit of tourists and others who wish rapidly to be taken round the public places of interest in London. The propelling power is obtained from a storage battery of 48 Tudor cells.

MOTOR CAB REGULATIONS.—During the Industrial Vehicle Exhibition at Olympia a meeting was held between representatives of various provincial local authorities and of motor vehicle manufacturers, when an understanding was arrived at, the result of which will probably be that many local authorities will allow to the motor cab industry more freedom in design and construction than is allowed under the London police regulations. These are needlessly restrictive in the case of smaller towns, but the tendency hitherto has been for the provinces to copy London in the matter.

SOCIETY OF MOTOR MANUFACTURERS AND TRADERS.—At the sixth annual general meeting of this Society on April 15, Mr. E. Manville presiding, the result of the voting for the new Council was reported, and the following were declared elected: Ordinary members: Messrs. E. M. C. Instone, J. D. Siddeley, C Jarrott, E. Powell, S. F. Edge, E. Gascoine, F. Lanchester, H. G. Burford, C. Johnson, T. H. Woollen, A. Brown, H. Austin, Harry Smith, J. E. Hutton, R. Dennis, S. Straker, W. G. Williams, G. Du Cros, P. Richardson, H. Du Cros, junr., E. Lisle, H. Sturmey, T. Clarkson, W. M. Letts, H. Johnson, F. Coleman, H. J. Swindley, H. J. Moyses, and F. R. Simms. Associate members: A. R. Atkey, G. Prosser, G. Mann, W. Parker Thomas, A. Farnell, A. C. Hills, H. Carver, Major F. Lindsay Lloyd, H. F. Lloyd, and H. G. Atkinson. At a meeting of the old Council Mr. E. Manville was unanimously requested to continue in office as president.

OMNIBUS TRAFFIC IN LONDON.—At an adjourned conference of representatives of metropolitan borough councils on April 6, at Hammersmith Town Hall, resolutions were adopted declaring that money raised from taxation of motor and other vehicles should be paid into a fund from which grants should be allocated to the local authorities towards expenditure on the roads; that the London County Council and the Corporation of the City of London should be requested to join in an endeavour to induce the Government to carry out the recommendation of the Royal Commission on London Traffic relating to the constitution of a central representative Traffic Board so far as regards street traffic; and calling the attention of the Chief Commissioner of Police to the increasing number of motor omnibuses which now break down.

THE SKIDDING OF OMNIBUSES.—Islington Borough Council brought an action in Clerkenwell County Court on April 10 against the London Road Car Company, to recover £30 5s. for damages to an electric light standard and lamp. For the plaintiffs it was stated that a motor 'bus belonging to defendants skidded when in Highbury Grove, and the rear end collided with the lamp-post and damaged it. As an alternative to negligence, they averred that the 'bus was a nuisance in the highway. The Judge said that there was no duty on the Borough Council to sand roads especially for motor traffic, and if dangerous machines were put upon the highway, no duty was cast upon the Council to minimise the danger by taking extraordinary steps with regard to the roads. The jury found that the use of the motor-omnibus was dangerous to the public using the highway and a nuisance. They also found that the damage was not caused by any defect in the road. Judgment was entered against the Road Car Company for the full amount claimed.

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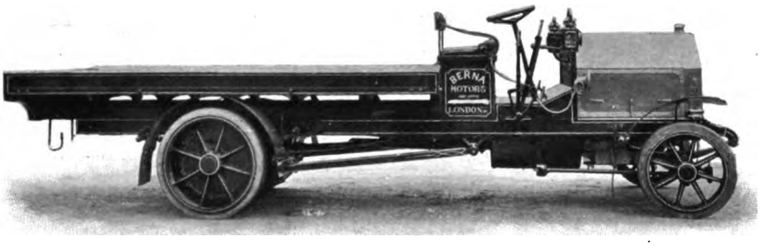

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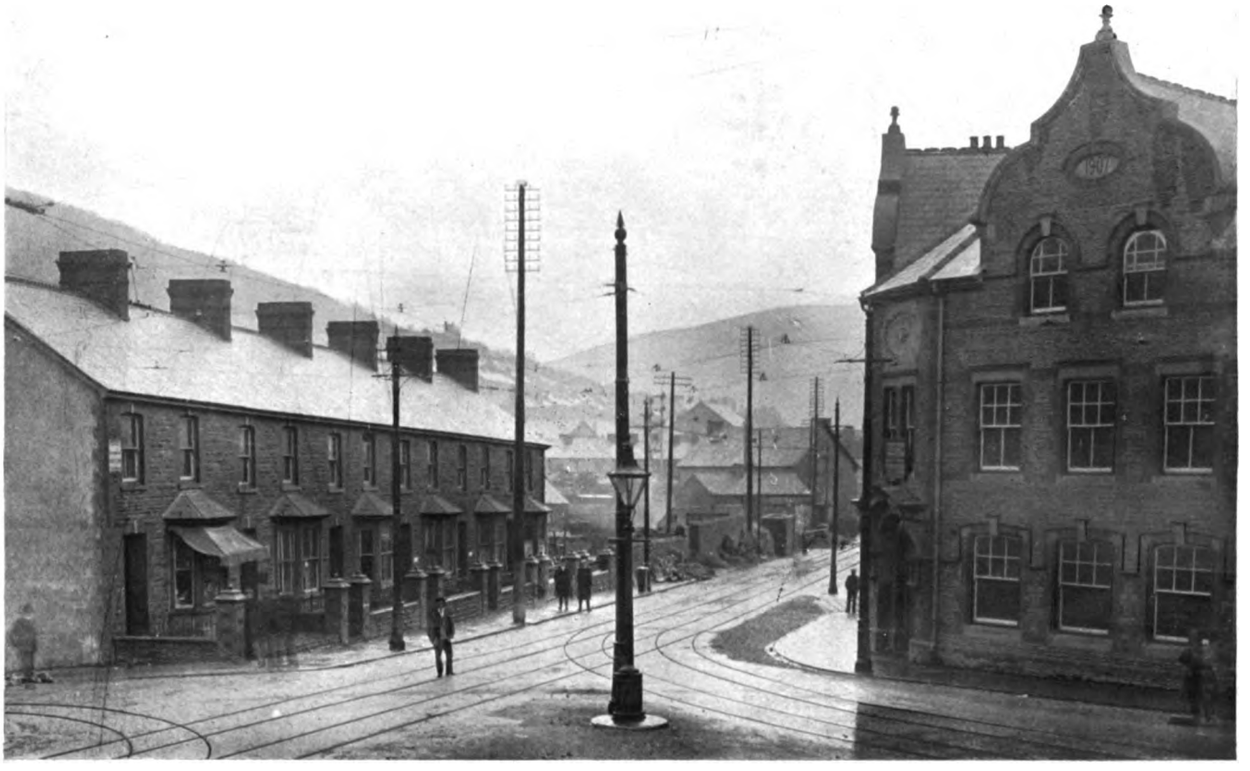
THE Tramway & Railway World
A REVIEW OF CURRENT PROGRESS IN ELECTRIC AND OTHER TRACTION

ESTABLISHED 1892. LONDON, JUNE 4, 1908. VOL. XXIII.

RHONDDA VALLEY TRAMWAYS.

Although the Rhondda Valley tramways have no feature of special importance from an engineering standpoint, the local conditions under which they have been carried out are of considerable interest. The whole of the tramways are laid on the public high roads running through the valleys of the Rhondda. The population, which is a mining one, is not grouped in large centres, but is continuous over the whole length of the tramways and aggregates about 250,000. Low working costs will be essential, but with cheap coal and other possibilities of economy offered by the district, there will be a good opportunity to show how economically electric cars can be worked under favourable conditions. As will be seen from the map on the following page, the Taff Vale Railway has lines running from Pontypridd up either side of the valley, and these lines have hitherto provided the only public means of travel in the district, so that with a tramway giving a more frequent service good traffic should be obtained. Happily the railway company can afford to regard the outcome with comparatively little concern. The Taff Vale has an exceedingly heavy and profitable mineral traffic, and it has probably been impracticable for the railway to devote as much attention to the passenger business as would have been given to it had the mineral traffic been less. In fact, it is quite possible that without the passenger traffic the profit of the railway company would be greater. In that case, the shareholders will have little reason to complain if this tramway relieves them of an unremunerative part of the business. The railway company has not hitherto given, perhaps, full consideration to this circumstance; for they have opposed the promoters of the tramway step by step.



Junction near Entrance to Tramway Depot at Porth.

Beginning with a hard-fought contest in the

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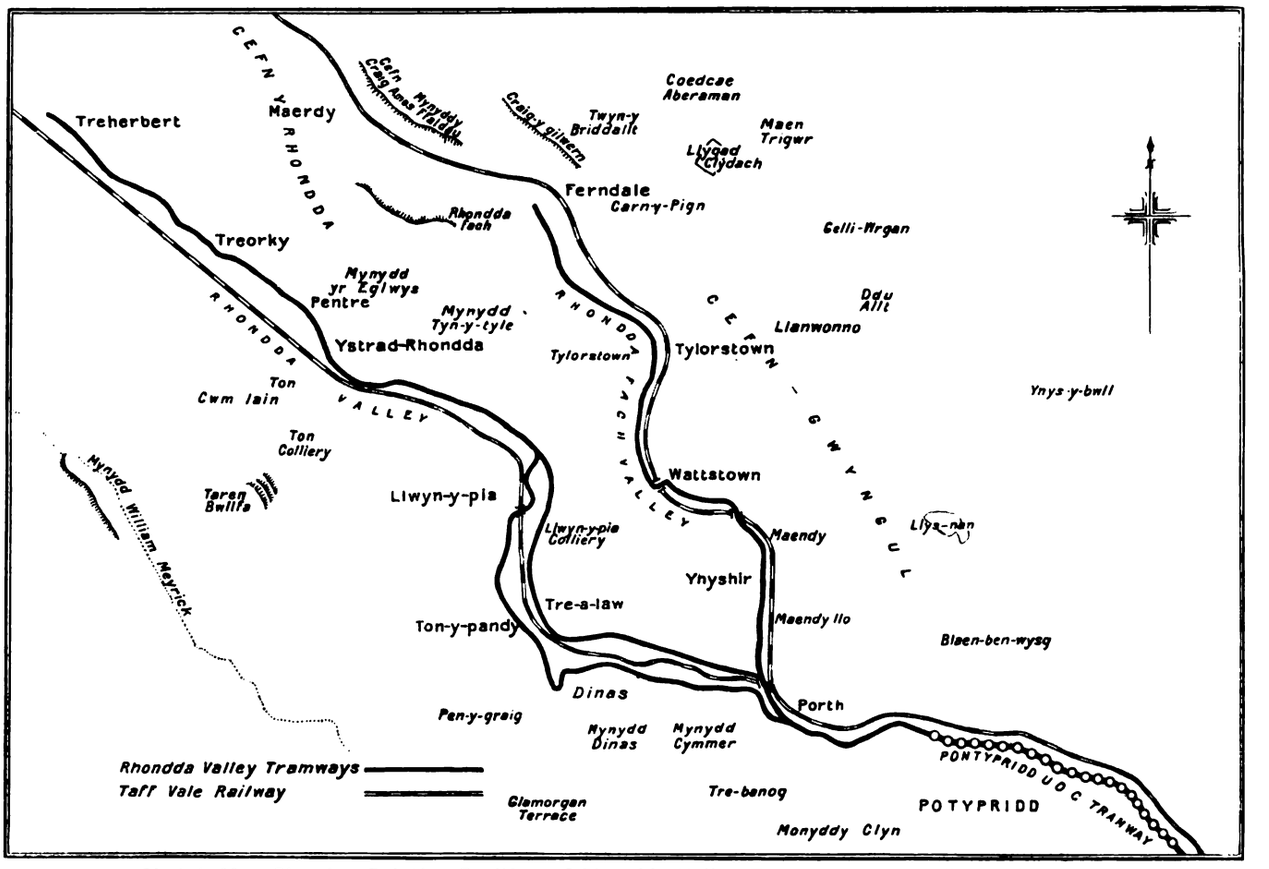
committee rooms of Parliament, nothing has been overlooked which might impress on the promoters the rashness of their undertaking. Arbitration has followed arbitration whenever an opportunity was presented, until every disputed point was placed beyond the possibility of further discussion. All this has, of course, entailed considerable delay and much expense, which might have been avoided to the advantage of the public and the contending parties. The whole history of the enterprise shows quite typically how unsatisfactory are the present methods of Parliamentary procedure for dealing with applications for powers to construct railways and tramways.

The commencement of the tramway enterprise at Rhondda is found as far back as 1882, when the Pontypridd and Rhondda Valleys Tramways Act was passed, under which a horse tramway was constructed. Some twenty years later, in 1902, the Rhondda Urban District Council obtained an Act under which it acquired the undertaking and powers for the construction of extensions. The Act of 1902 contains one provision which is, we believe, unparalleled. In order that no loss should fall on the ratepayers Parliament inserted a clause providing that the Council should not commence the construction of the tramway until they had entered into an agreement with some company or person to lease the tramway after its construction for a period not exceeding 42 years, at such rent and upon such other conditions as might be approved by the Board of Trade. The clause also provided that the rent to be paid to the Council should not be less than the sum sufficient to pay the interest on any money expended. The Rhondda Tramways Company, Limited, which was formed in 1906, has acquired the powers granted to the Rhondda Urban District Council by the Acts of 1902 and 1905, and the Council has granted to the company a lease of the lines for 42 years at an annual rent of £2,250, which includes the sinking fund and interest charges on £60,000, the approximate cost of the tramway tracks. The power-station is the property of the Rhondda Tramways Electric Supply Company, Limited, which is closely identified with the tramways company.



Sketch Map Showing Relative Position of Rhondda Valley Tramways and Taff Vale Railway.

The whole system and power-station has been constructed by the National Electric Construction Company, Limited, for the Rhondda Tramways Company, Limited. The whole of the track is now nearly completed, the total length being as follows:

Single line..	10 m.	4 fur.	5·8 chs.
Double line	6 m.	7 fur.	3·8 chs.
Route length	17 m.	3 fur.	9·6 chs.
Length reduced to single track	24 m.	3 fur.	3·4 chs.

The track is laid on the public roads, which in some cases are narrow. There are numerous gradients, the steepest being 1 in 12 for a distance of 80 ft. Curves are frequent, but in no case is the radius less than 42 ft. 6 in. The gauge is 3 ft. 6 in., and the permanent way

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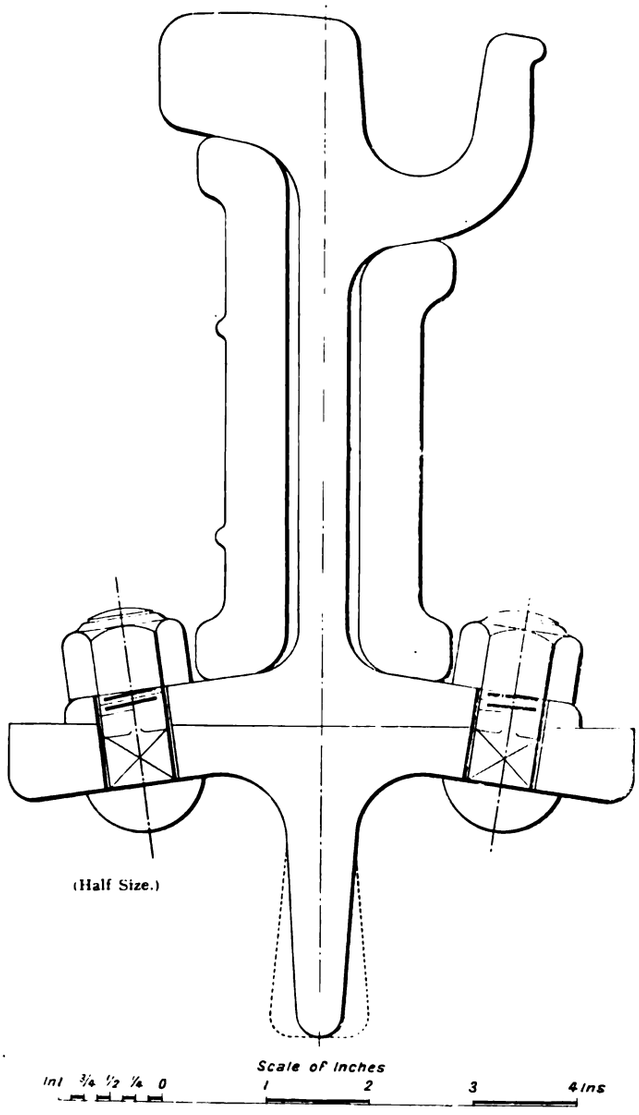
presents no unusual feature, except the rail joints, to which we refer below.

The rails, which were supplied by the North Eastern Steel Company, are of the girder type, weigh 95 lb. per yard, and have the following dimensions: Length, 45 ft.; depth, 6 in.; width of base, 6 in.; width of head, $3\frac{5}{8}$ in.; width of groove, $1\frac{1}{8}$ in.; depth of groove, 1 in. The composition is in accordance with the British standard. The fish-plates have also been supplied by the North Eastern Steel Company, and they are 24 in. long and weigh 50 lb. per pair. There are six bolt holes, $1\frac{1}{8}$ in. diameter. The bolts are $3\frac{1}{2}$ in. by 1 in., and are secured by lock-

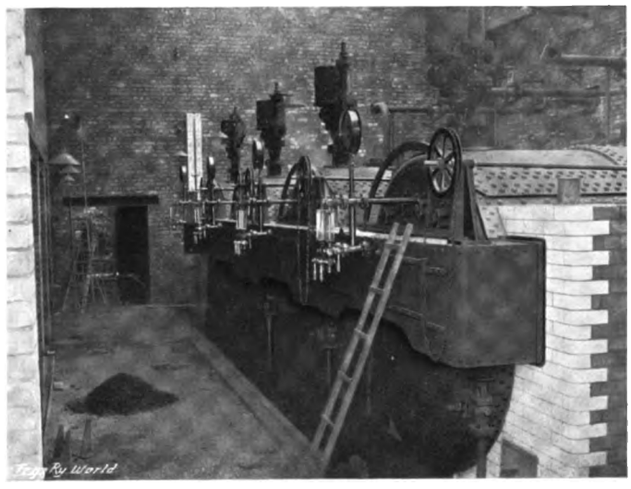


Section of Rail and Sole Plate.

nuts supplied by Bayliss, Jones, and Bayliss, Limited, of Wolverhampton, who are also the makers of the tie-bars, 2 in. by $\frac{3}{8}$ in., which are of the usual pattern, and are placed at intervals of 7 ft. 6 in. Sole-plates of the section, shown in an accompanying illustration, have been used throughout the lines. Those sole-plates are 28 in. in length, and were manufactured by Edgar Allen and Company, Limited, of Sheffield. They are bolted squarely to the underside of the rail, and the shape of the central web makes it possible for the concrete to be well rammed in about the whole of the sole-plate. The sole-plates are specially rolled so that the top of the rail flange is parallel to the underside of the flange of the T. Ordinary bolts are used without the taper washers, which are necessary when inverted rail sole-plates are used. The rails are bonded at each joint with two "protected" bonds of 0000 wire, 12 in. in length, supplied by the Forest City Electric Company, of Manchester.

The special track work, including railway crossings, and the points and ordinary crossings, are of imperial manganese steel, and were manufactured by Edgar Allen and Company. The points are 10 ft. 6 in. and 7 ft. in length. The rails are laid on a bed of 6 to 1 concrete, 8 in. deep. The track between the rails and for the usual margins is paved with Norwegian granite.

The trolley wire is flexibly suspended from span wires or side poles. The gauge is 000 S. W. G. and the wire, which has a breaking strain of 24 tons per square inch, is of figure 8 section and was supplied by the British Insulated



Interior of Boiler Room.

and Helsby Cables, Limited. It is divided into half-mile sections. The span wire is 7-12. Guard wires are of 7/16 galvanized steel. The poles are in three sections and weigh 686 lb., 900 lb., 1,200 lb., and 1,600 lb.

The power-station, which has been erected at Porth adjacent to the car-shed, is conveniently situated at the junction of two main routes. The building measures 88 ft. by 82 ft., and has a height of 32 ft. It is of brick, with a chimney of steel. The height of the latter is 145 ft., and its diameter varies from 11 ft. at the base to 5 ft. at a height of 15 ft., and from this point to the top the same diameter is continued. The chimney weighs $16\frac{1}{2}$ tons and stands on an iron bed-plate, being secured by holding-down bolts. Internal angle rings serve to support a brick lining to a height of 30 ft. inside. It was supplied and erected by Messrs. Ashmore, Benson, Pease and Co., of Stockton-on-Tees.

In the boiler room, which measures 50 ft. by 33 ft., are four Davey-Paxman economic boilers,

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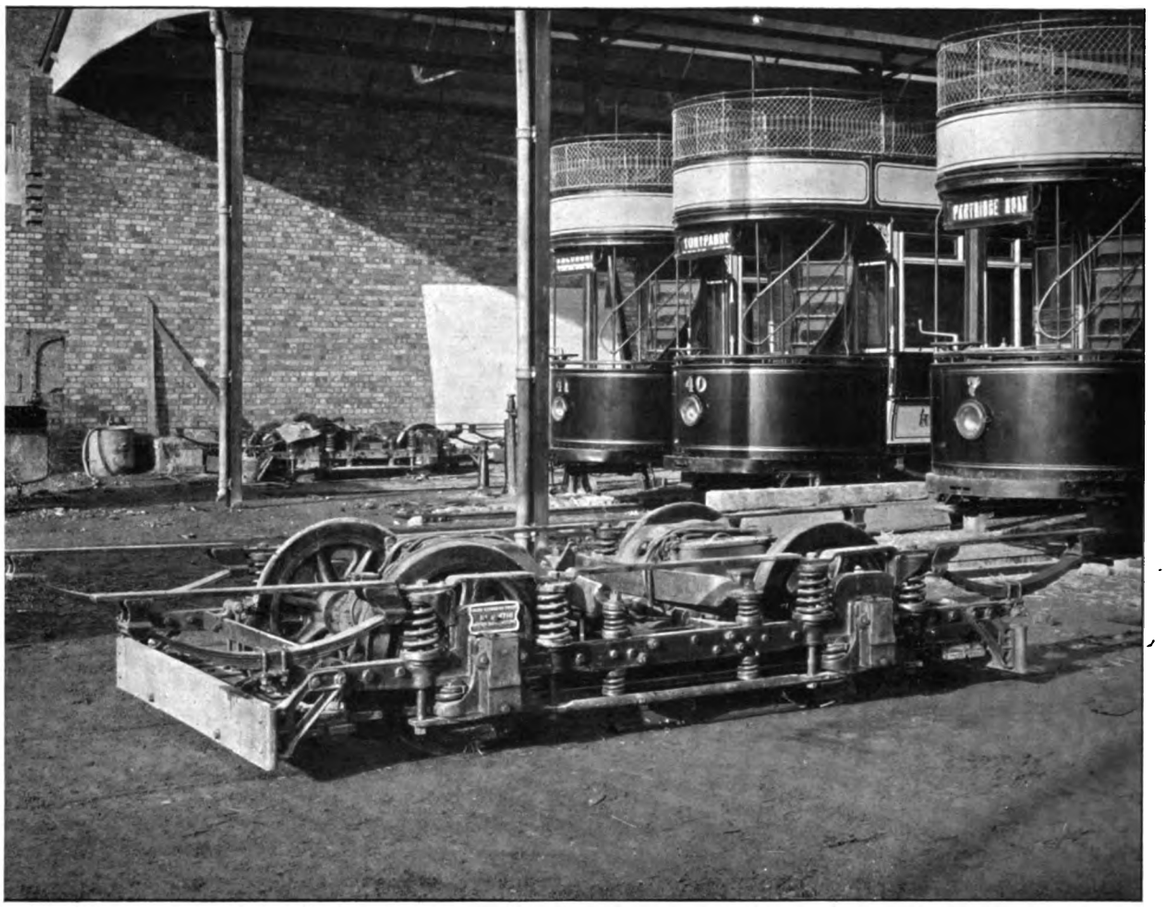
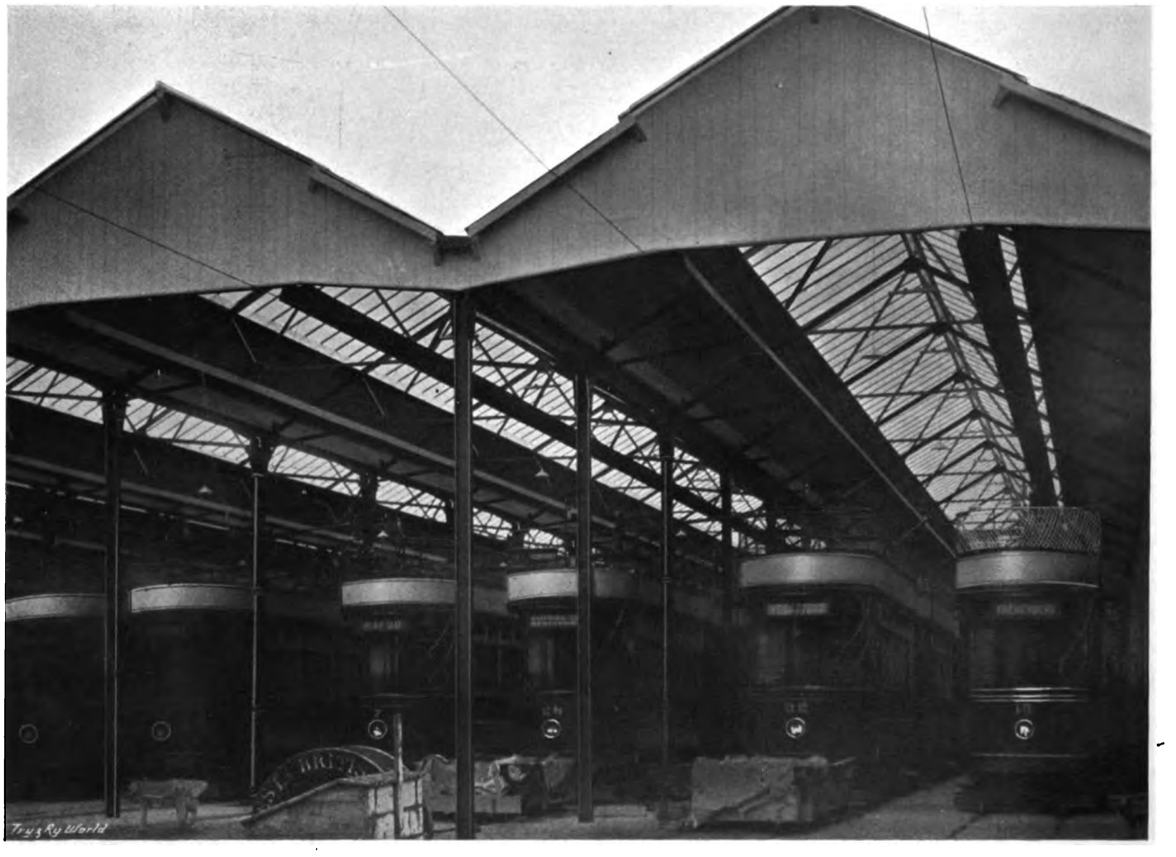


Cars and Trucks—Rhondda Valley Tramways.



Early Morning at the Car Sheds—Porth.

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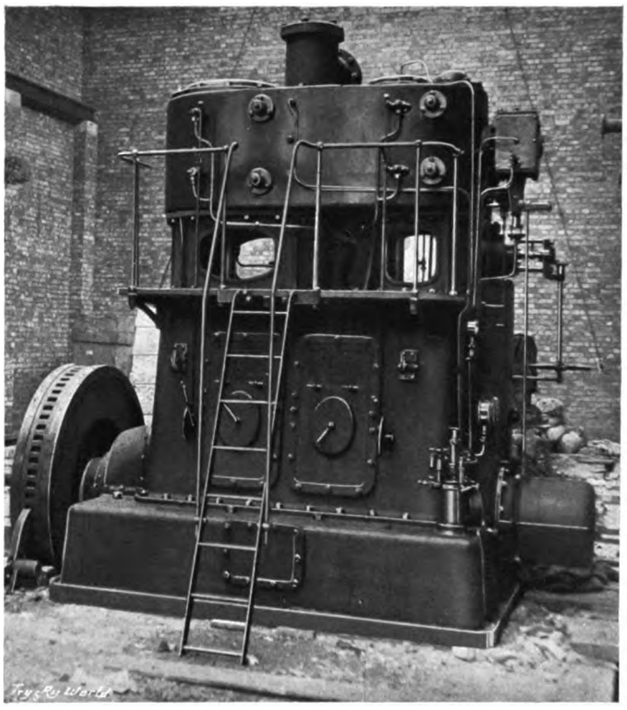
each 14 ft. by 8 ft. The heating surface of each is 1,160 sq. ft., the grate area of 31 sq. ft., and the steam pressure is 200 lbs. Paxman superheaters have also been installed, and are capable of evaporating 5,000 lbs. of water per hour at 200 lbs. pressure per square inch. The boiler mountings were supplied by J. Hopkinson and Company, and the boiler coverings by Davey, Paxman and Company. The main steam pipe is 12 in. in diameter, and the branch steam pipes are 5 in. The feed water pumps were supplied by G. and J. Weir, Limited. A grease separator, which is capable of dealing with 20,000 lb. of exhaust steam per hour, has been provided. The water for the boilers is taken from the River Rhondda, which is also the source of supply for the surface condensers, which are of the Mirrlees-Watson type, and are capable of dealing with 15,000 lbs. of steam per hour

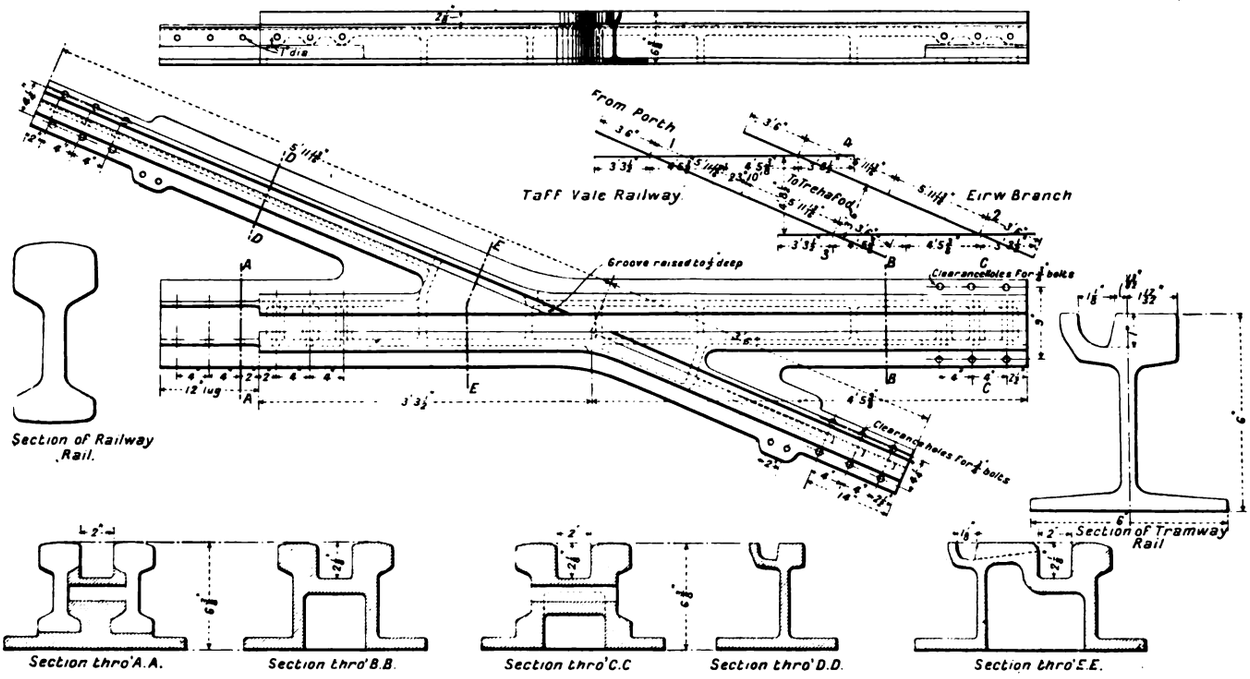


One of the Engines in Course of Erection.

The engine room measures 80 ft. by 36 ft. Here are two triple expansion double-acting engines, and one two-crank double-acting engine, each of 435 B.H.P. The engines, which were manufactured by Davey, Paxman & Co., have fly wheel governors.

Six generators have been supplied by the Lancashire Dynamo Company. Three of these are direct-current machines having a capacity of 230 KW. direct-current (550 volts and 300 amps.) and an efficiency of 92 per cent. The efficiency of engine and generator is 84 per cent. The other three machines are 110 K.V.A. three-phase alternators, and each has an output of 100 KW. at 5,500 volts, 25 periods. One direct-current and one three-phase generator are each coupled direct to one engine. The motor generators, manufactured by the Lancashire Dynamo and Motor Company, are driven from the direct-current machines.

A feature of the equipment at the main generating station and the sub-stations will be the fly-wheel storage sets, each consisting of a regenerative motor driving a 6 ton fly-wheel at from 670 revolutions to 950 revolutions per minute. The magnets of the regenerative motor are wound in such a way that temporary overloads are compensated by the fly-wheel sets, which again accumulate energy when the load is below the normal. In this way the loads on the engine are largely equalized. The fly-wheel



Special Work at Railway and Tramway Level Crossing, Porth.

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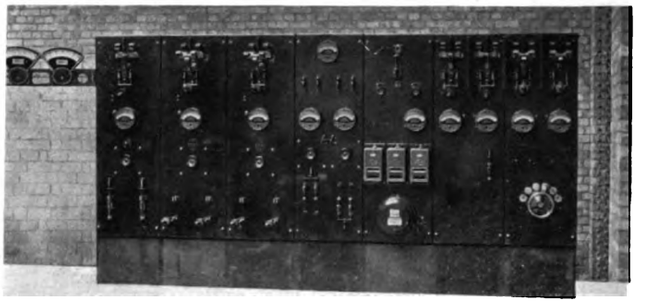
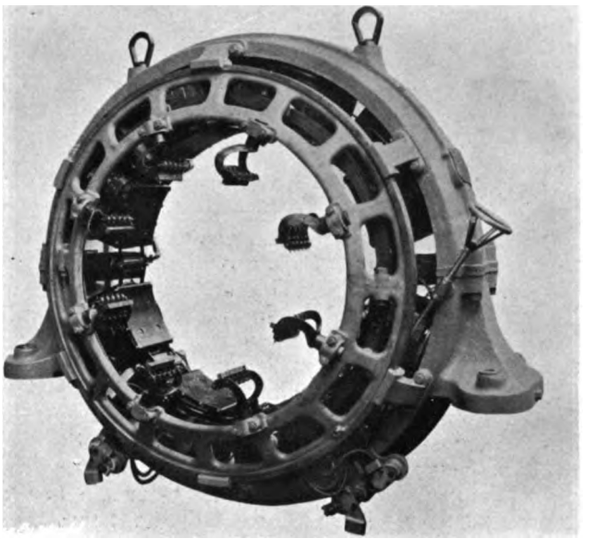
sets were manufactered by the Lancashire Dynamo and Motor Company under the Kelsall and Warburton patents. These sets will be capable of meeting peaks of 150 amperes for two minutes, 200 amperes for 1½ minutes and 300 amperes for ¾ minute. At each sub-station are two six-phase rotary converter and step-down transformers. Each rotary has an output of 100 KW. at 550 volts and 750 revolutions per minute. The switchboards, high-tension and low-tension, are by Cox-Walker, Limited.

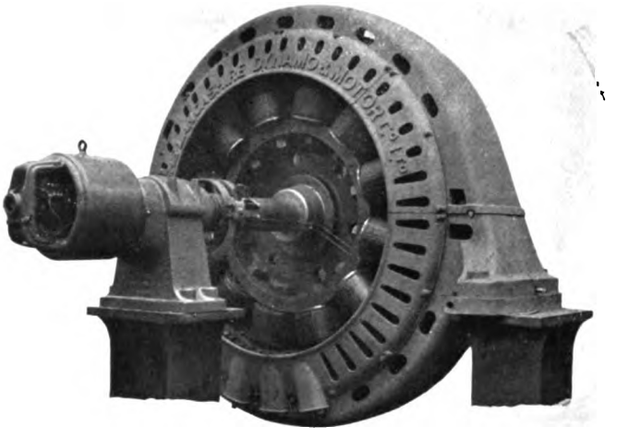
The feeder system consists of high-tension alternating-current mains to the two sub-stations and low-tension direct-current mains. There are two duplicate high-tension and eight low-tension feeders, four of the latter are run from the generating station, two from each sub-station. The makers of the cables were the British Insulated and Helsby Cables, Limited. All cables are laid on the solid system. There are six feeder pillars, the nearest being approximately 200 yards from the station, and 31 section pillars. All of these were supplied by Watlington and Company, Limited. There are three track returns, viz., 1 sq. in., ·7 sq. in., ·5 sq. in. respectively, and an overhead track booster feeder. The underground feeders are of the paper-insulated type, but the overhead feeders are bare. Telephones have been placed in each feeder box, so that there is communication with the power-house and car-sheds from any point of the line.



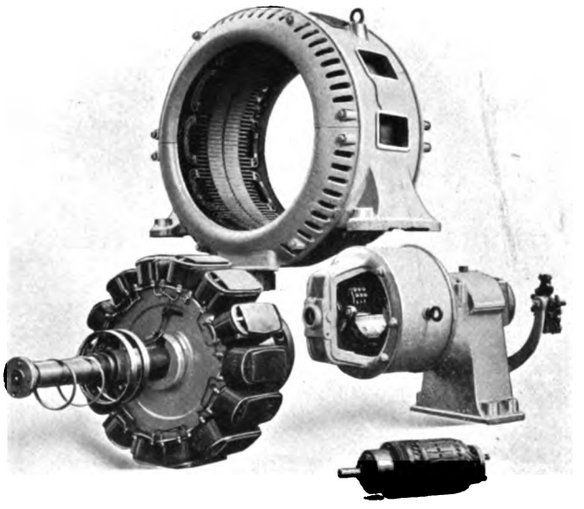
Part of Switchboard.



Magnet Frame of Multipolar Generator.



Revolving Field Type Three-phase Alternator.
With Direct-coupled Exciter.



Parts of Three-Phase Alternator.

The rolling stock consists of 50 cars of the single truck top deck type. They were supplied to the contractors, the British Thomson-Houston Company, by the Brush Electrical Engineering Company and are mounted on Brush trucks, type A, with 31¾ in. steel-tyred wheels, and weigh complete about 10 tons. The axles are 4 in. in diameter. The trucks have a 6 ft. wheel-base and a spring-base of 11 ft. 3¼ in. The cars measure over all 27 ft. 6 in., the inside seating length being 15 ft. Width over all is 6 ft. 3 in., giving width on floor sills 5 ft. 3 in. The height over centre of floor to ceiling is 6 ft. 9 in. The cars carry 48 passengers, seats being provided inside for 22 and outside 26. All the cars are equipped with Hudson and Bowring's life-guards and folding steps. They have wheel and slipper brakes, with Peacock's attachment.

The electrical equipment of the cars include

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two G. E. 58 motors of 30-35 B.H.P., manufactured by the British Thomson-Houston Company.

The car shed, which is situated at Porth, is 210 ft. in length and 86 ft. 10 in. in width. There are eight tracks, providing a track length of 490 yards.

For the whole of the engineering work Mr. Reginald P. Wilson has been responsible, as consulting engineer for the Rhondda Tramway Company; and on Mr. Cownie, the general manager, and Mr. F. E. Stanley, the chief engineer of the National Electric Construction Company, has fallen the principal work in connection with the long parliamentary contest and various arbitrations. Sir Douglas Fox and Partners have acted as consulting engineers for the Rhondda Urban District Council.

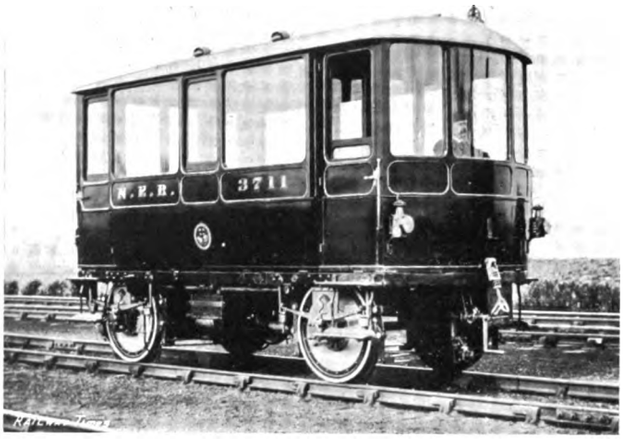
NEW PETROL RAIL MOTOR INSPECTION CAR.

The North Eastern Railway Company have lately constructed at their carriage works at York, and put into traffic, an interesting type of petrol rail motor car, primarily designed for the use of their executive officers when making periodical inspection journeys over the railway. The car is 17 ft. long and 7 ft. wide, with a wheel-base of 10 ft., and is arranged with a driver's compartment at each end and an open saloon 10 ft. long in the middle. The saloon is entered through either of the driver's compartments, and has permanent seating accommodation for six passengers, while two camp stools provide extra seats. The ends and roof are shaped to offer as little resistance to the wind as possible.

Motive power is provided by a 35-40 H.P. four-cylinder petrol engine, with cylinders $4\frac{5}{8}$ in. diameter by $5\frac{1}{2}$ in. stroke, giving a normal speed of 950 revolutions per minute. The induction and exhaust valves, which are placed on opposite sides of the engine, are mechanically operated. An ordinary centrifugal type governor is attached to the exhaust cam shaft. Duplicate ignition is provided, viz., Eisemann's high-tension, and ordinary low-tension. The carburettor is of the Krebb type, gravity fed. The cylinders and main bearings of the engine are lubricated by a "Dubrelle" lubricator fixed in the driver's compartment, and driven from the engine by a small countershaft. The engine is, of course, controlled from either end of the car. It is mounted on an independent frame built up of light steel channels, and carried on inside journals on the axle by means of roller bearings. The centre line of the engine shaft is also the centre line of the driving axle. The driving wheels have no springs between the axle-boxes and the frame, but at the trailing end helical springs are interposed between the trailing axle boxes and the frame. These boxes work in horn plates with a radius described by the wheel-base, and take off a considerable amount of shock between the rails and the engine frame.

The gears, fitted with rigid shafts, are fixed to the underframe and carried in gun-metal bearings, and give three speeds in either direction, viz.: slow, 15 miles per hour; medium, 30 miles per hour; and fast, 45 miles per hour; the latter speed is transmitted direct from the engine to the bevel gears on the driving wheels. The rotary motion is applied to the driving wheels by a pinion fixed to the end of the engine shaft, and arranged to gear with either of the two large bevels fitted on a sliding sleeve on the driving axle. The centre part of the axle is of square section to receive the sleeve and bevels, which give the forward and reverse movements, and are operated from the driver's compartment by a horizontal reversing screw. A "Hele-Shaw" clutch is used between the engine and its work, operated by hand levers placed in the driver's compartments.

The body frame is built up of light channels and angles, and is carried on roller bearings with journals $2\frac{1}{2}$ in. diameter by 5 in. placed outside the wheels, and is therefore quite isolated from the engine frame, so that any vibration set up by the engine or gears cannot be communicated to the car. Two water tanks, each holding seven gallons, are built into the framing, and these, while giving a certain amount of steadiness to the body, form the water supply for the engine; a system of radiating pipes being fitted between the latter and the tanks. The four wheels of the car are of the Mansell type (wood centres), 3 ft. diameter, and are of the ordinary North Eastern Railway standard so far as the tread and flange are concerned. A hand brake of very powerful design, operating four blocks on each pair of wheels, is placed in the driver's compartments at each end of the car: while warning and other signals are given by a loud horn coupled to the engine exhaust and operated from either end of the car, where also sand can be applied to the rail when travelling in either direction.



New Inspection Car on the North Eastern Railway.

Above the waist rail a clear outlook is obtained in every direction for inspection purposes, single pillars only being used to carry the glass of which the sides and ends are chiefly composed. A table is placed in the middle of the saloon, the lower part of which gives access to the top of the engine, whilst suitable trap-doors in the floor give access to other parts of the gear. Electric light on the storage principle is fitted, and a speed indicator is placed in the driver's compartment. Externally, the carriage is finished in the ordinary North Eastern style. The car in running order carries 15 gals. of water and 20 gals. of petrol, and weighs complete 6 tons 12 cwt. The consumption of petrol averages one gallon to 12 miles, so that the capacity of the tank is equal to a journey of 240 miles. During the trials the car has run a distance of some 1,200 miles without a mishap of any kind, and speeds upwards of 55 miles per hour have been obtained.

Trolley Omnibuses.—Following up the recent report by Mr. Peter Fisher, the general manager, Dundee Tramways Committee have decided to send a deputation to the Continent to inspect and secure all possible information regarding systems of electric omnibuses running on ordinary roadways, and taking current by trolley from overhead wires. The deputation includes Mr. A. Speed, convener of the Tramways Committee; Mr. Johnston; Mr. H. Richardson, the electrical engineer; and Mr. Fisher, the manager.

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THE CENTRE OF GRAVITY OF STEAM AND ELECTRIC LOCOMOTIVES.

By W. H. Booth.

In their studies of electric locomotives electrical engineers have, it must be confessed, paid far too little attention to what has already been accomplished or thought out in the past, or forced upon the notice of engineers by the immutable laws of mechanics. It has been pointed out that the great boiler of a steam locomotive raises the centre of gravity high above the rails, and this has been used as an argument in favour of the electric locomotive, with its small wheels and the weight of so much of its motors centred in the axle centre. A little research into history would have shown that this question of low centre of gravity was much to the fore sixty years ago. Engines built before 1850 often had their cylinders placed very close down to the rail level, their rods sloping upwards to the cranked axle. Thus the centre of gravity was kept low. Boilers were sometimes made with deep indents in the lower part of the barrel, so as to clear the revolving cranks, and many of the locomotives of the early days presented a singularly squat appearance as the result of successful efforts to secure a low position of the centre of gravity.

In the exhibition of 1851 there was on view the "Cornwall," a locomotive with wheels of 8 ft. 6 in. diameter. The axle of this engine was above the boiler, and in some cases large tubes were put transversely through boilers to take an axle, or other means were employed of putting the boiler low. Locomotives built to-day have their centre of gravity over 5 ft. above the rail. This height is not nearly so great as a casual observer might be disposed to place it, but the fact is that the modern boiler, though so highly pitched over the frames, is by no means so heavy in its upper parts as might be anticipated. The boiler tubes are all in the lower part of the barrel, and the upper part is a mere empty shell, except for the steam in it. Experience has proved that the high centre of gravity is better than the low. Let the two extreme cases be supposed, first, that of the centre of gravity actually at rail level. In that case every departure of the rail from straightness is the cause of a blow from the full weight of the engine. All surgings of the engine, swayings, lateral movements are converted at once into direct blows on the rail and the flange of the wheel. The fastenings of the rail are exposed to the very maximum of shearing stress, chairs are apt to be broken, and the engine itself is exposed to severe stresses. With the opposite extreme of a centre of gravity at an infinite height above rail level there can be no transfer of rail blows on the wheel flanges to any part of the engine. The engine would simply swing from side to side without shock to the rails.

In actual practice, the centre of gravity being about 60 inches above rail, the angle of pressure of the resultant of any swaying movement of the centre of gravity is almost exactly 60 degrees; for the centre of gravity forms with the two rails an equilateral triangle, or nearly so. The tendency to force outwards the rails is much reduced, as compared with the tendency of a low centre of gravity engine to do so. It has been argued that with a high centre of gravity an engine tends more easily to overturn; but while this may be the case, let it not be forgotten that in rounding a curve the lateral tendency of the centre of gravity is to press the outer wheel more firmly down upon the rail, whereby its flange is restrained from mounting the rail. Were it not for this increased pressure the wheel would more easily mount the rail and run off. When an excessive speed is run round a curve, either the engine will run off the rail or it will turn over. To check one tendency is to increase the other, and for every curve there is, no doubt, a certain speed, could it be found, which best suits an engine, and gives a maximum safety in conjunction with the degree of allowed super-elevation of the outer rail. The overturning of an engine is not likely to do much greater harm than its derailment, and it is better to face the former as the lesser of two evils, for the high centre of gravity is favourable to easy running and reduced wear and tear.

Discredit was thrown upon electric locomotives last year by the fatal accident on the New York Central Railroad at the Bronx. This appears to have been entirely due to a low centre of gravity of the electric locomotive. Designers would do well to abandon the low centre of gravity. Much help would be given by raising the whole of the motor. Direct connection, it is true, is much valued, but it may well be wondered if too big a price has not been paid for the abolition of gears. This price has been the use of very small wheels, the necessity for very large motors, and the fixing of the centre of gravity very low, a lowness that has been accentuated by the absence of the boiler. In the steam locomotive all the moving parts and the cylinders and valves are practically at the level of the axle centre, and only the boiler remains to produce even a height of 5 ft. Otherwise the centre of gravity of the steam locomotive would be little or nothing higher than that of the electric locomotive.

In the steam machine, height, as stated above, has proved distinctly advantageous, but this fact has been ignored, and virtue has actually been claimed for the low position. It is even possible, if not probable, that this seeking for a low centre of gravity under a mistaken idea of its advantage has influenced designers to attempt the gearless machine. Many engineers would, it is certain, prefer to employ larger wheels and geared motors in order to raise the centre of gravity of the machine to an easier and safer level. Gearing badly designed and badly arranged, has not shown up very badly in the electrical tramcar. Electrical tramcars have never had put into their construction a tithe of the good mechanical work and material which have gone to the making of a steam locomotive. A first-class geared electric locomotive constructed in a steam locomotive shop would, it may not too rashly be surmised, prove that a geared electric motor is not, after all, of necessity a poor contrivance. It would enable radical differences of design to be introduced, and put a stop to the necessity, which at present seems to be paramount, of the small wheel. Even with the best of design, assuming that the geared system proves all that can be desired or anticipated, it is not likely that the centre of gravity of the whole machine can be raised as high as it is in the steam engine, unless special highly-placed weights are added for the purpose, and this is undesirable, as, indeed, is all redundant weight.

The weight of the motor parts should not come upon the wheels except through the intermediary of springs. This complicates the problem of gearing, but a solution seems possible in the direction in which it has been solved by the makers of traction engines, wherein a form of Oldham's coupling seems to give satisfaction in solving the difficulty of the gear centres.

Aberdeen Watering Car.—The Aberdeen Corporation tramways department have built a new watering car with a tank capable of holding 2,000 gallons. The sprinklers deal with a road breadth of 24 ft. Pipes are also provided for washing the rail grooves. The weight empty is about 6 tons, and two 30 H.P. motors are fitted. The Westinghouse magnetic brake is used. Mr. Pilcher, the tramway manager, is responsible for the design of the vehicle.

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Midland Railway Electrification:

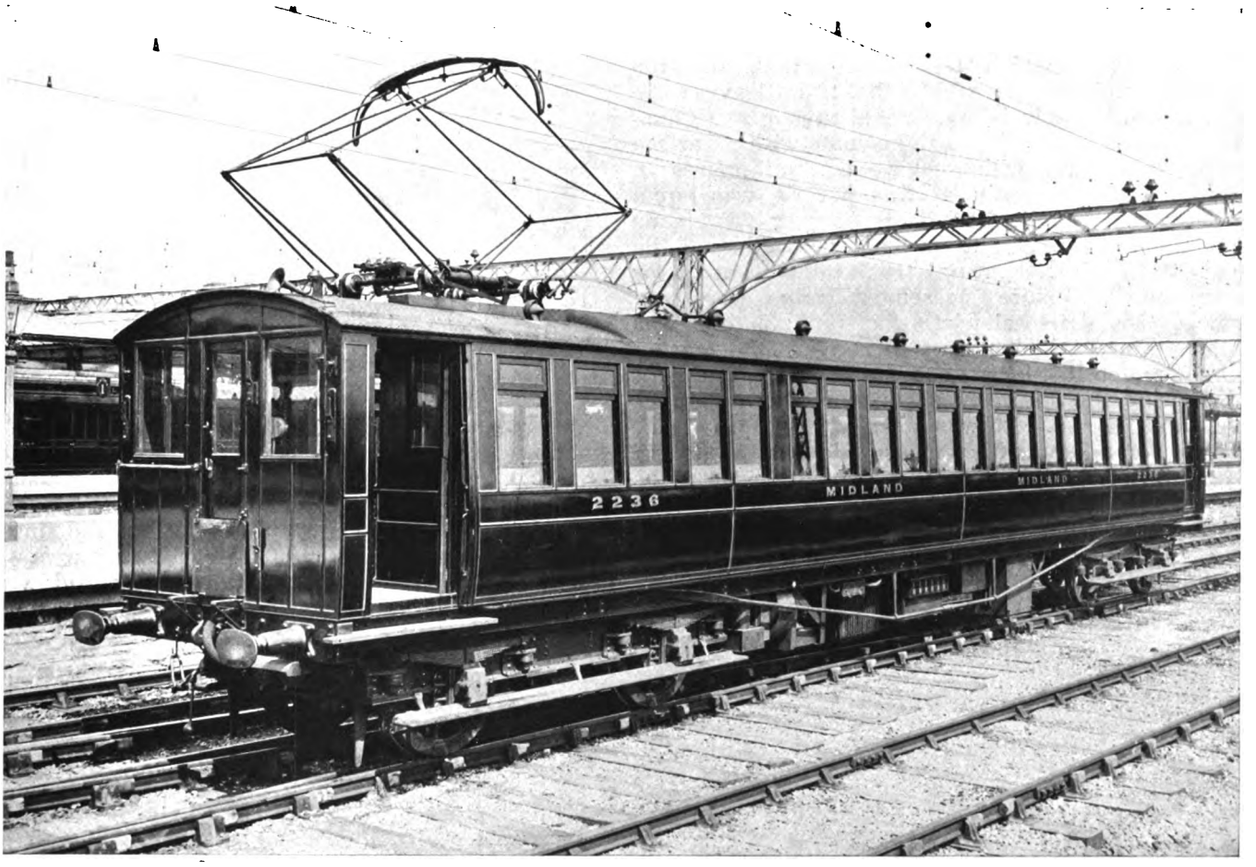
THE HEYSHAM, MORECAMBE, AND LANCASTER LINE, THE FIRST SINGLE-PHASE SYSTEM IN BRITAIN

THE branch line of the Midland Railway connecting Heysham, Morecambe and Lancaster is the first railway in the country to be equipped for electric traction on the single-phase alternating current system. Electrical working on the section between Morecambe and Heysham began on April 13, and traffic commences on the Lancaster-Morecambe section on June 8. This line and the Victoria to London Bridge section of the London, Brighton and South Coast Railway which is being electrified are looked upon by the exponents of single-phase traction as the forerunners of many other installations of the kind. The experience of the two railway companies concerned in the working of the sections named will be of importance in determining the point. All that can be said now is that while the best and the worst of the continuous-current system of working are thoroughly known, the good points and the bad of the single-phase system—despite some experience abroad—are as yet more or less theoretical in this country. That by experience the good points will be further improved, and the bad points minimised or removed goes without saying, while in the case of the continuous-current system the corresponding process has already been pretty completely accomplished.

The detailed description which follows embodies the information officially supplied, and to the officers of the Midland Railway Company we desire to tender our acknowledgments.

OVERHEAD EQUIPMENT.

The overhead construction of the Heysham, Morecambe, and Lancaster line has been designed and carried out under the direction of Mr. W. B. Worthington, the chief engineer of the Midland Railway Company, by Mr. J. Sayers, the telegraph engineer of the company, and Mr. Argyle, the northern divisional engineer. It is similar as regards the type of suspension to that adopted for the electrification of the Hamburg-Altona Railway, the chief difference between the two installations being the new type of suspension of the catenary, which is the design of Mr. Sayers.



Westinghouse Car, showing Bow Collector and Fire Screen on Roof and Apparatus suspended on Underframe.

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The length of line electrified comprises the double roads between Heysham and Morecambe; Morecambe and Lancaster Green Ayre; and the single line from Lancaster Green Ayre to Lancaster Castle Station, the total length of single road being about 21 miles. A diagram plan is shown on the following page. From this plan it will be seen that the line passes under a large number of overbridges, mostly of the arched shape, and the clearance of these bridges has been a matter of considerable interest.

The use of a single bow trolley for travelling in both directions necessitates the bow being symmetrical about the centre line of the coach, and this brings the bow necessarily very close to the structure of the bridge. In order to get through at all it is necessary to take the contact wire well out towards the centre of the arch, so that it may come down low but yet be clear of the loading-gauge, and so that the other end of the bow may clear the structure properly. The Lune Viaduct presented a special problem, as it is on a 9-chain curve and terminates at Lancaster Station, which is also on a curve. The contact wire is of the figure 8 section, and is run in lengths of from 800 to 1,000 yds.

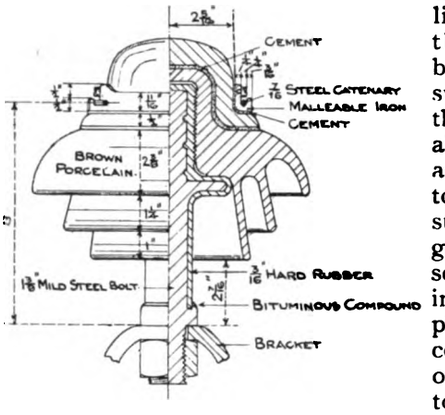
One end of each length of the contact wire is fixed through insulators to a terminal gantry, and the other end is attached through suitable pulleys, etc., to a weight equal to about 1,200 lbs. The fixed end is always that at which the train enters, and the weighted end that at which the train leaves; the tendency of the bow is therefore always to straighten the contact wire. It is worthy of note with regard to the contact wire, which is 70 sq. millimètres in section, that the strain at first put on was equal to 800 lbs., and the horizontal stagger was made equal to 4 ft., that is, 2 ft. from the centre line of the coach, but the experimental trials which went on for some months before passenger trains were run showed that the total friction of pull-offs, etc., was such as to make it necessary to increase the tension to about 1,200 lbs. for a 1,000 yards length, and with this tension the strain goes fairly evenly throughout the whole length. It was also found that a 4-ft. stagger for a bow which measured from tip to tip 7 ft. 1 in. was too much for practical purposes for running at high speeds. The line is situated in a country swept by very violent gales, experiencing the worst of weathers, and it is now considered that a stagger of 2 ft. is a more practicable figure, though part of the line is actually run with 3 ft. stagger at present.

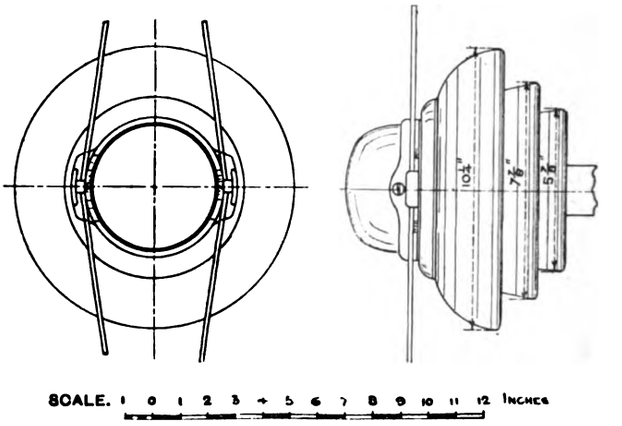
The height of the contact wire from rail level varies from 18 ft. 3 in. in the open to 13 ft. 3 in. under bridges. It is suspended by short loops about 4 inches long from a steel cable called the auxiliary wire. The loops are fixed to the contact wire, but are movable on the auxiliary wire. The auxiliary wire, again, is held by two main catenary cables, the main catenary span being thus broken up into six short spans on the auxiliary.

The two catenary cables are clipped together throughout their length, except for about 3 ft. on either side of the insulator, where they divide to pass through the grooves of a ring, the grooves being on opposite sides of the insulators. The catenary is therefore free to move for this distance, and this equalises the strains in spans due to unequal loading; at the same time it is secure in the case of the breaking of the wire, as has been proved by experience.

Section switches are provided so as to isolate the up and down lines or to isolate the different branches. These switches are of the double-break air pattern and are fixed on the top of the poles supporting the gantries. Each section switch is in addition duplicated, and the connection from one contact wire to the section ahead of it is accomplished by means of a short section of switch wire which requires to be connected to the two contact wires before the line is switched through at this point. This arrangement was adopted in order to get a duplicate break, and, what is more important, a short length of line into which a car can run without bridging by means of its bow two sections which it was supposed might require to be isolated. The switches are provided with padlocks. A similar type of switch is in use at the various stations to enable the station staff to earth the overhead wiring in case of emergency.

The gantries are connected together by a separate overhead steel cable, which is earthed every half mile, the same earth plates being used for lightning arresters of the horn type, the object being to reduce the number of earth plates requiring attention





Section and Plan of High-Tension Insulator.

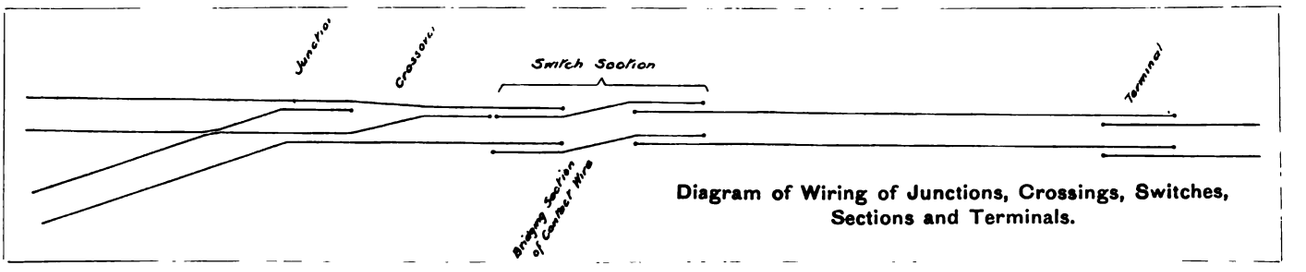


Diagram of Wiring of Junctions, Crossings, Switches, Sections and Terminals.

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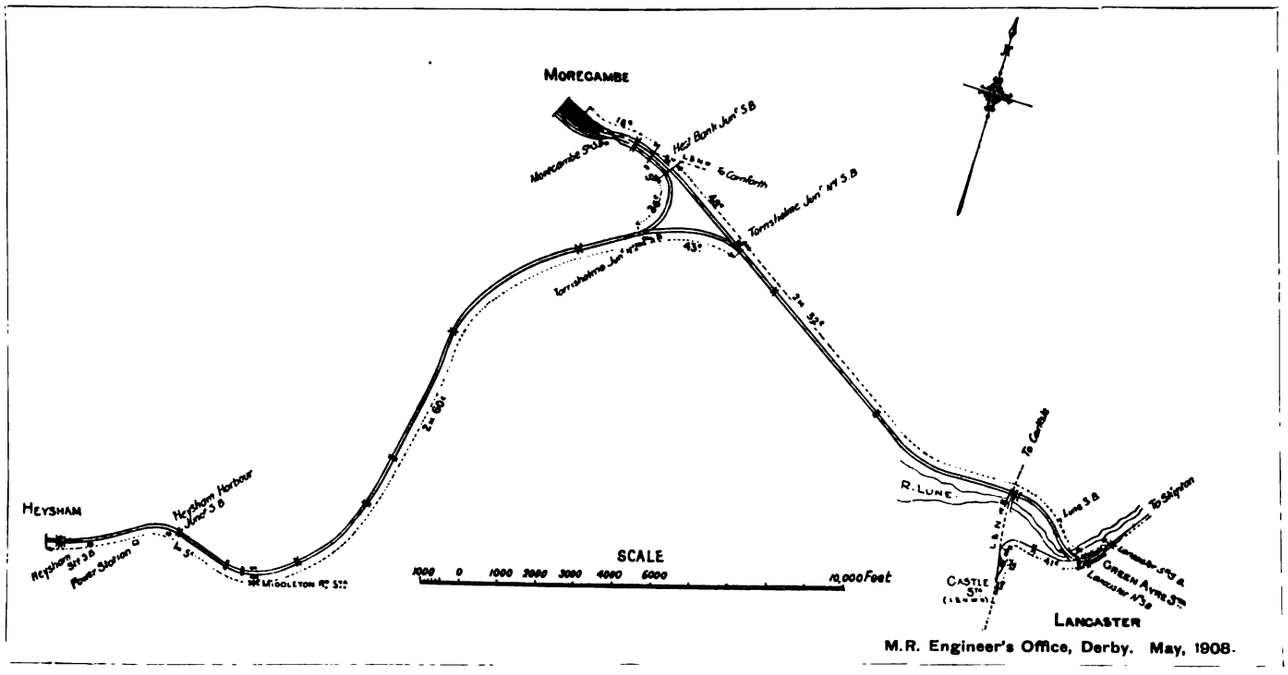
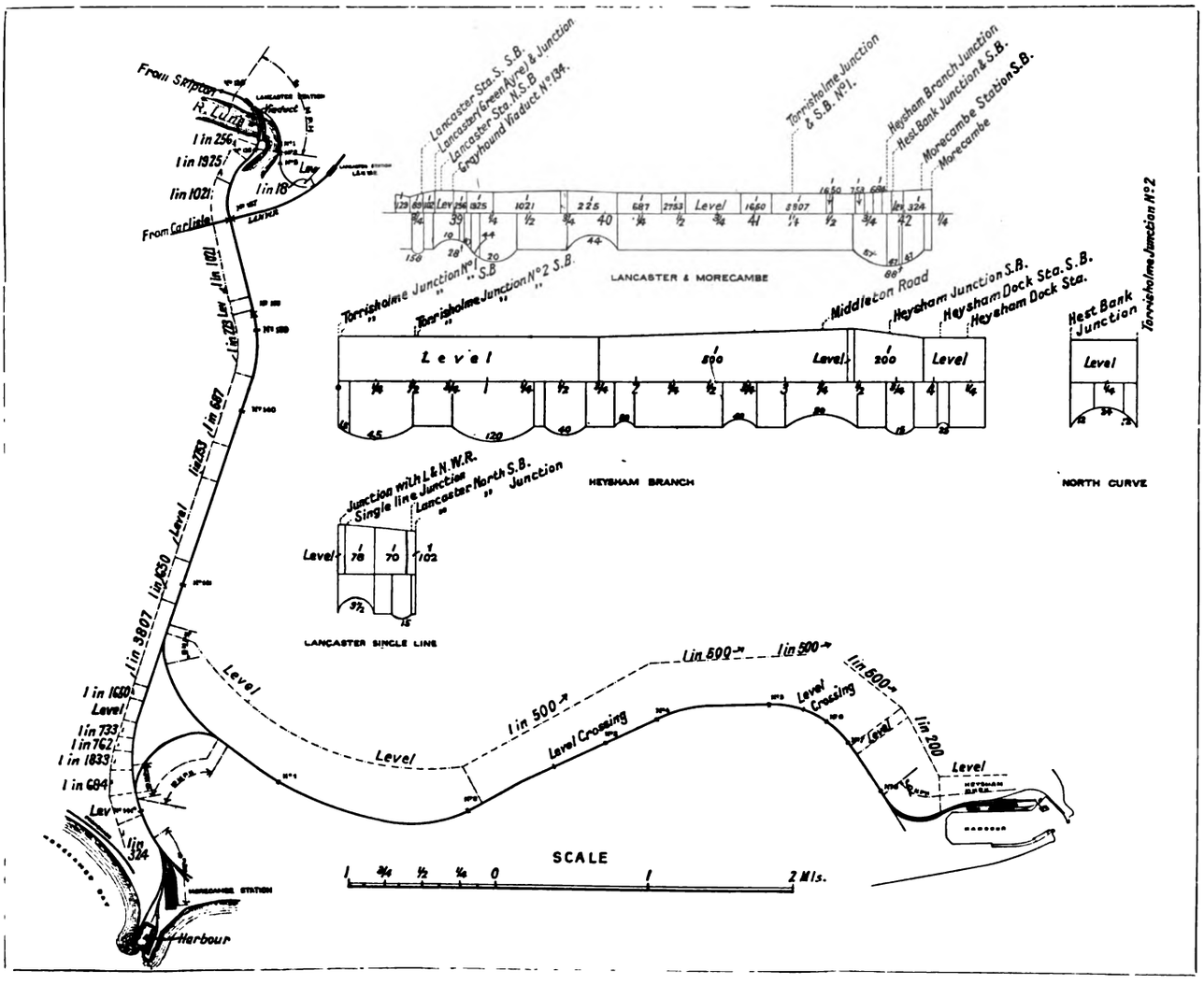


Plan of Lines, Showing Overbridges, etc.



Plan and Diagram of Gradients.
Lancaster, Morecambe, and Heysham Branch—Midland Railway.

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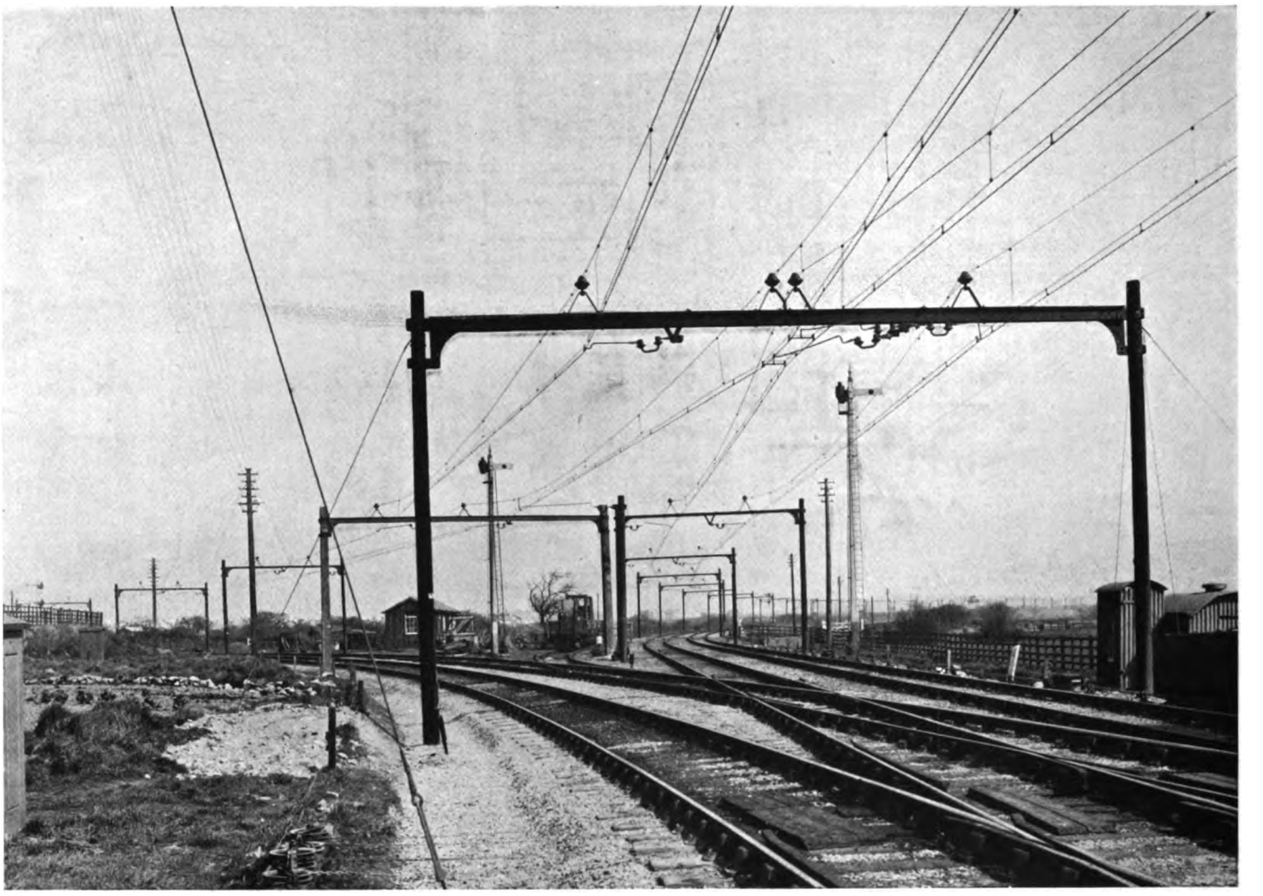
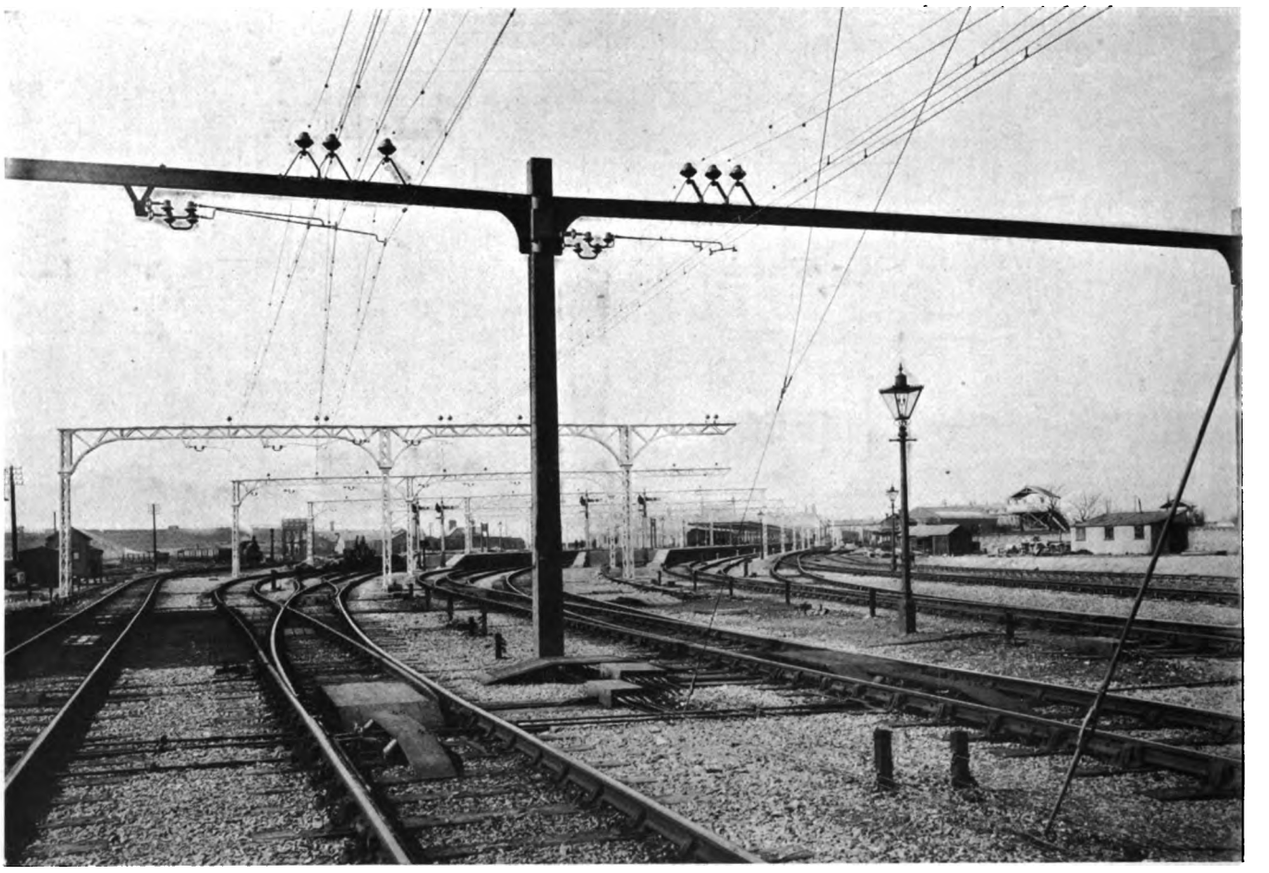


Catenary Suspension at Torrisholme Junction.



Gantry Construction over Multiple Roads at Morecambe Station.

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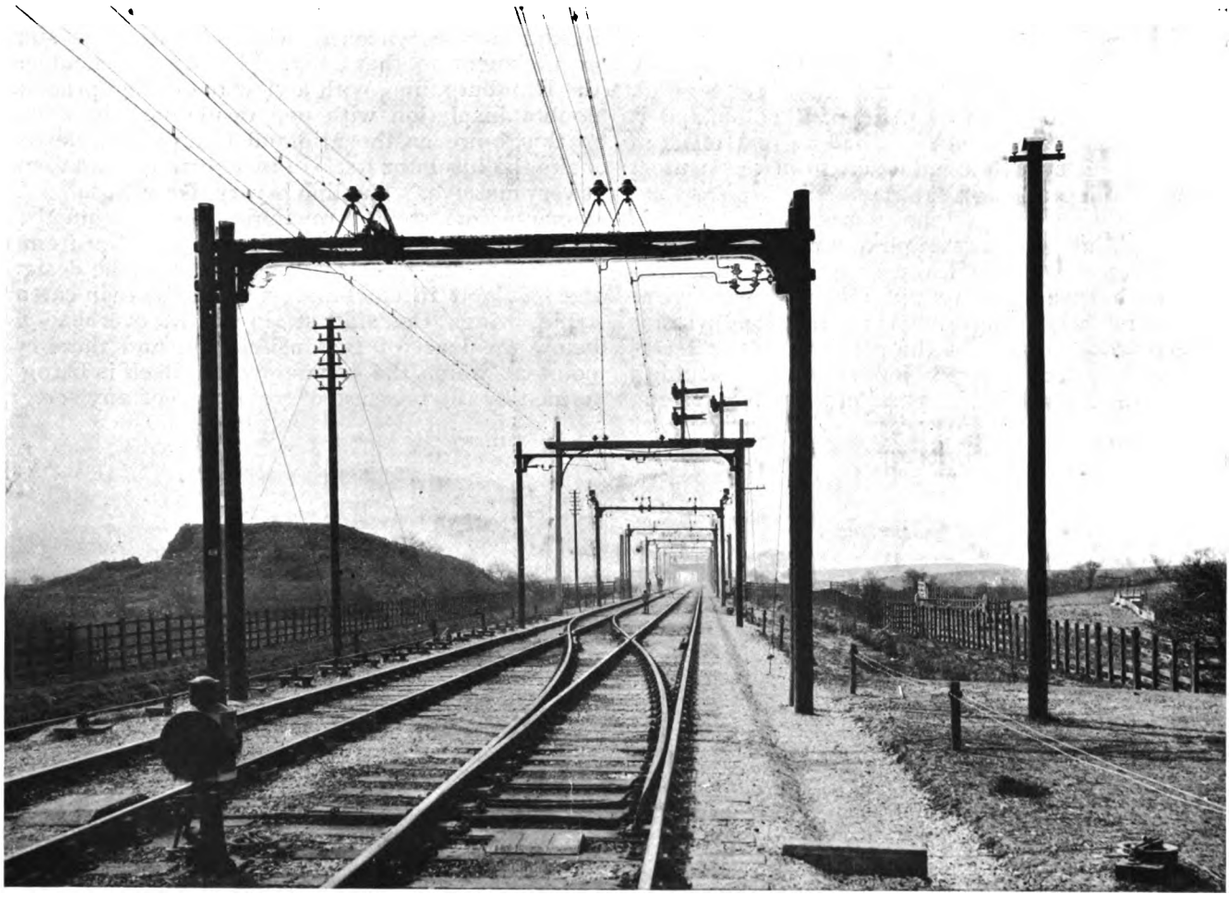
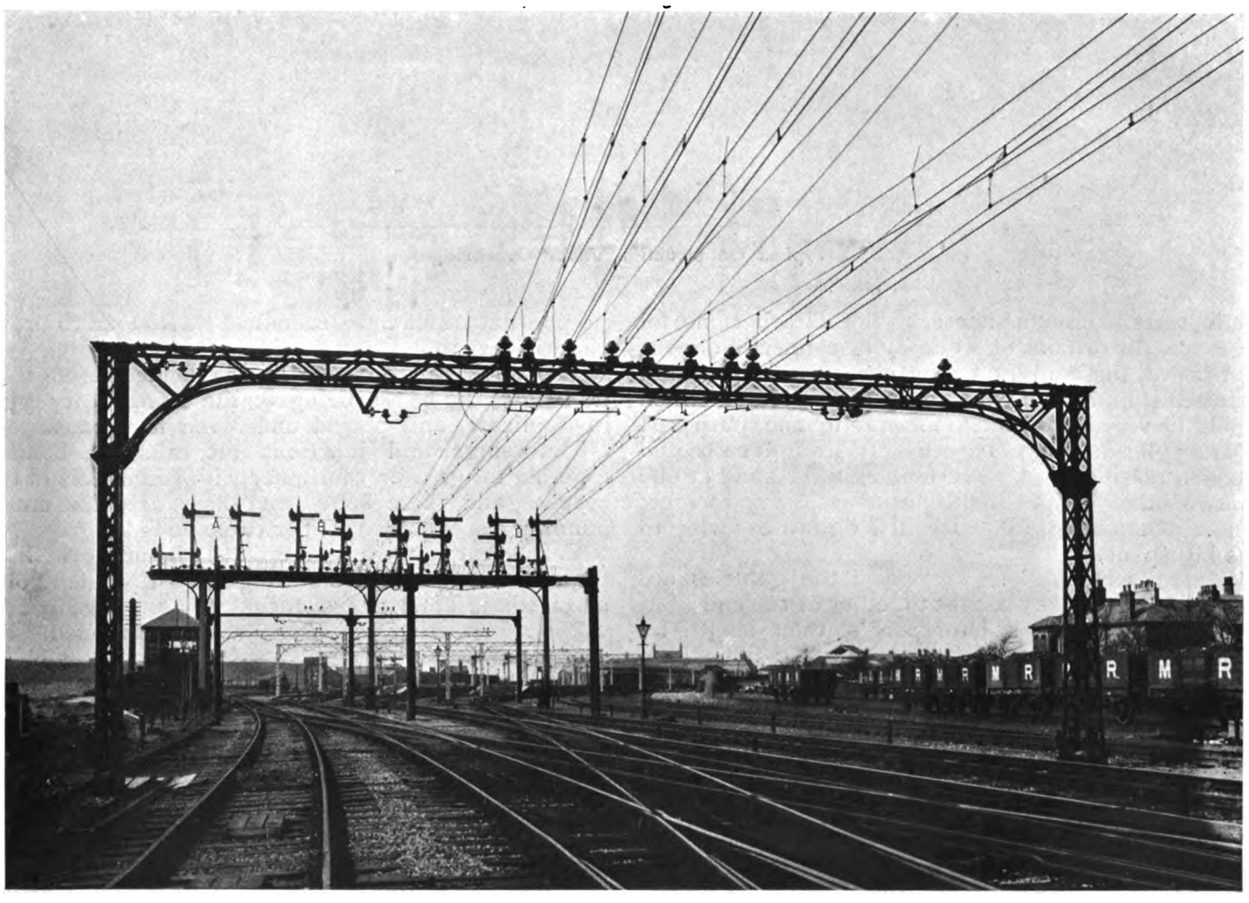


Catenary Suspension on Straight Road and Cross-Over.



A Wide Span Lattice Girder Gantry Carrying High-Tension Wires.

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and thus to give better security from danger due to the poles being charged by a leaky insulator. This earthed steel cable has been erected in every case between the contact wire and the telegraph wires, which are open on one side of the line, and it is believed that its presence has had a great effect in reducing the electrostatic induction from the contact wire to the telegraph wires.

It was the object of the company to avoid if possible cabling their telegraph and telephone wires, and so far the results are favourable to the idea that it will not be necessary to put all such open wires underground when high-pressure traction systems are erected overhead. At the same time it will certainly be necessary to provide some sort of high resistance leak on any wire parallel to such a system, as in certain circumstances, if the wire became, for instance, thrown out of work by disconnection at the test board, there might be an electrostatic potential between it and earth with a very high voltage which would be very inconvenient for maintenance purposes.

The poles used have been mostly straight creosoted wooden poles, but at Morecambe Station and at one or two other points it has been necessary to erect lattice steel poles and lattice girder gantries owing to the big spans.

Where wooden poles are used the gantries are made of two angles brought together at the ends, but kept apart for the greater part of their length by distance pieces 1 in. thick, enabling the bolts from the insulator saddles to drop in the gap, so giving a great range of adjustment of the insulator position without any necessity for drilling.

The design of the insulators is best shown on page 438. Before getting out the dimensions the company's staff took advantage, by the kindness of Messrs. Siemens Bros., of the experiment this firm undertook to ascertain what was the minimum distance at which a 6,600-volt, 25-cycle circuit would maintain an arc in the heaviest weather from an insulator shed. It will be noticed that the steel bolts supporting the insulators are encased with ebonite — a similar arrangement to that adopted by Messrs. Siemens on the Hamburg line, with a view to getting practically double insulation with one insulator. In addition to this, however, the Midland Company preferred to make the insulator itself in two portions, and to make it very massive. The line is very likely to suffer from damage from stone-throwing at the large number of level crossings, and in addition will suffer from the worst of weathers. It will be seen that the design of the insulator in combination with the twin catenary cable brings the side strain of the overhead gear below the level of the inside bolt, and there is no point at which the catenary cable itself is being deformed by the pressure of any clamp of any sort, and no point at which the mechanical waves tend to break the wire at a point of reflection.

Typical Construction under Overbridge.

The outer rail on each line is bonded throughout its length, the bonds being of the Forest City type, in duplicate, and placed under the fish-plates. At all crossings and junctions all rails are bonded together for greater continuity with the wheels of the coaches, and these bonds and those used for cross-bonding are ordinary copper cable bonds.

Very great care was exercised, in bonding the line, to prevent any moisture getting into the drilled holes or on to the bond plugs during the process, and in very wet weather the work was abandoned. By means of protective devices it was found possible to go on with bonding in moderately wet or damp weather, but the tests carried out when the whole of the work was finished of the resistance of each bond showed in an interesting manner that, although the bonds were absolutely first class, those which were carried out in perfectly dry and fine weather were quite distinguishable, by resistance test, from those which were carried out in damp or misty weather. It will be interesting to note, as time goes on, whether this difference in resistance is intensified.

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As will be seen from the plan of the line (page 439), the rails are earthed at Heysham Harbour in the sea by duplicate copper earth plates. At Morecambe they are earthed at the end of the Midland Railway Pier; these plates are also of copper, but for protection they are dropped into a large cast-iron caisson recovered from an old Midland bridge. At Lancaster the rails are earthed to the cast-iron columns of the bridge, where they rest in the bed of the river, where water is always flowing. Recording ammeters were put in these various earths, with a view of indicating the proportion of current which returns by these routes.

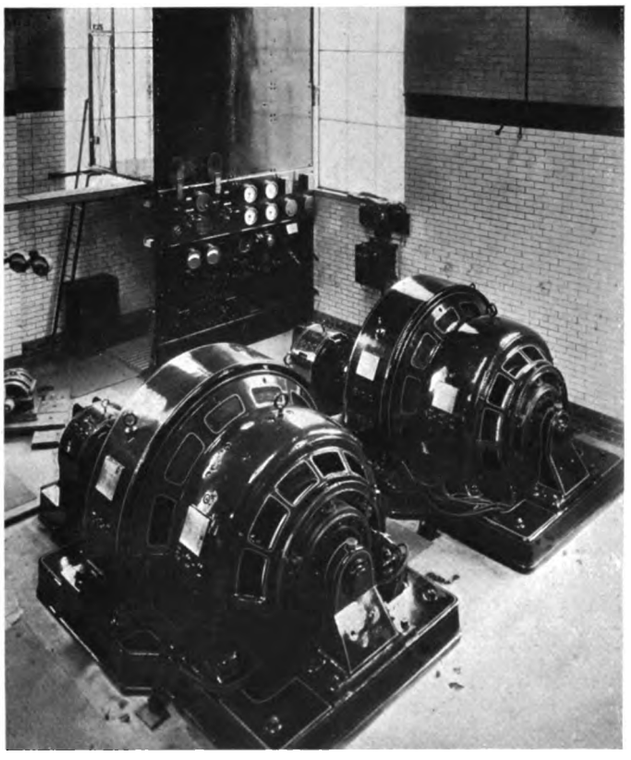
The overhead wire works at a potential of 6,600 volts, single-phase alternating current, 25 cycles.

POWER STATION.

The line is supplied from the existing power station, situated at the Heysham end of the line, which has had added to it the necessary machinery to increase its capacity, and to enable it to supply single-phase current, as hitherto it has been a direct-current station. There are no feeders other than the two contact wires.

The existing power station is that provided for working the cranes, capstans, lifts, and other machinery, together with lighting of the harbour at Heysham. This station is a gas-driven one working from "Mond" producers, by the Power Gas Corporation. There are two producers of about 750 to 1,000 h.p. capacity each, with the accessory blowing, steam producing, cooling and cleaning apparatus.

The engine-room contained three 250 h.p. three-cylinder British Westinghouse Co.'s engines, driving

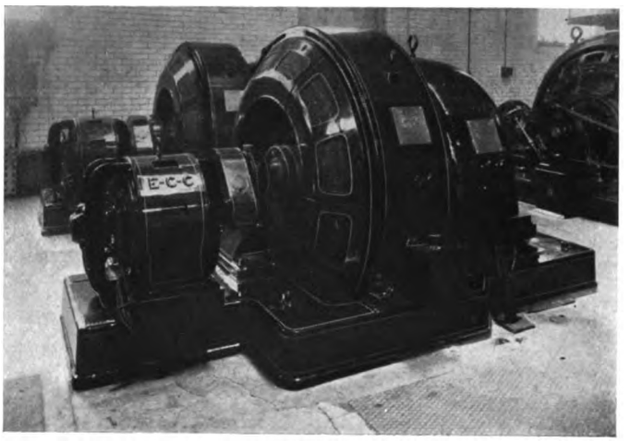


Switchboard and Motor Generators.

150 kw. (direct current, 460 volts) generators. There was also installed a battery having a capacity of 100 kw. for 5 hours, with the usual corresponding rates for shorter and longer periods. The existing load on the station, consisting chiefly of fast speed, heavy-motored cranes, is very variable and the battery has been used, in conjunction with a British Westinghouse Co.'s automatic reversible booster, for taking up the "peak" loads.

In connection with the traction scheme, an additional 350 h.p. 235 kw. Westinghouse Co.'s engine and generator, also generating 460 volts direct current, has been added. The single-phase current is obtained through two D.C.-A.C. motor generators, by the Electric Construction Co.

From the nature of the traffic the demand on the



E.C.C. Motor Generator.

station will be one of a very "peaky" character, and with very heavy "peaks." During these "peaks" the whole possible output of the machinery at work in the station must be utilised; and the intention is that the engines, whatever the actual load they may be working on previous to heavy loads coming on, shall work up to their full overload capacity—which is about 20 to 25 per cent. in the case of the old, and 10 to 15 per cent. in the case of the new sets—before the battery is called upon to discharge heavily. The latter will, however, be called on to work up to its full one-hour rate of 750 to 1,000 ampères. The old battery booster not being large enough for these discharges, a new one has been installed, built by the Lancashire Dynamo & Motor Co., whose machine is particularly suited for this method of working. A difficulty was, however, found in that the generators were working on a very falling portion of their characteristics and their pressure dropped badly as their loads increased, this having been compensated for by hand regulation of their excitation, or else during "peaks" they continued to work at their previous loads, and the battery supplied the excess, both courses being inadmissible under the new conditions.

Compound winding in the usual way was an extremely expensive remedy since, as the copper necessary for full excitation was already on the fields, new series coils would be excessively large and heavy, added to which was the trouble of entirely dismantling the machines. A very simple solution was found in fitting exciters, each mounted on the engine bedplate, and compound windings being fitted on these exciters and varying their voltage and consequently that on the main generator fields, so that the existing copper on the latter was fully utilised. This not only proved a very much cheaper arrangement, the exciters being only of 3 kw. capacity and of fairly high speed, but enabled the whole change to be made in the course of a week, obviating any dismantling or any serious stoppage of the generating sets.

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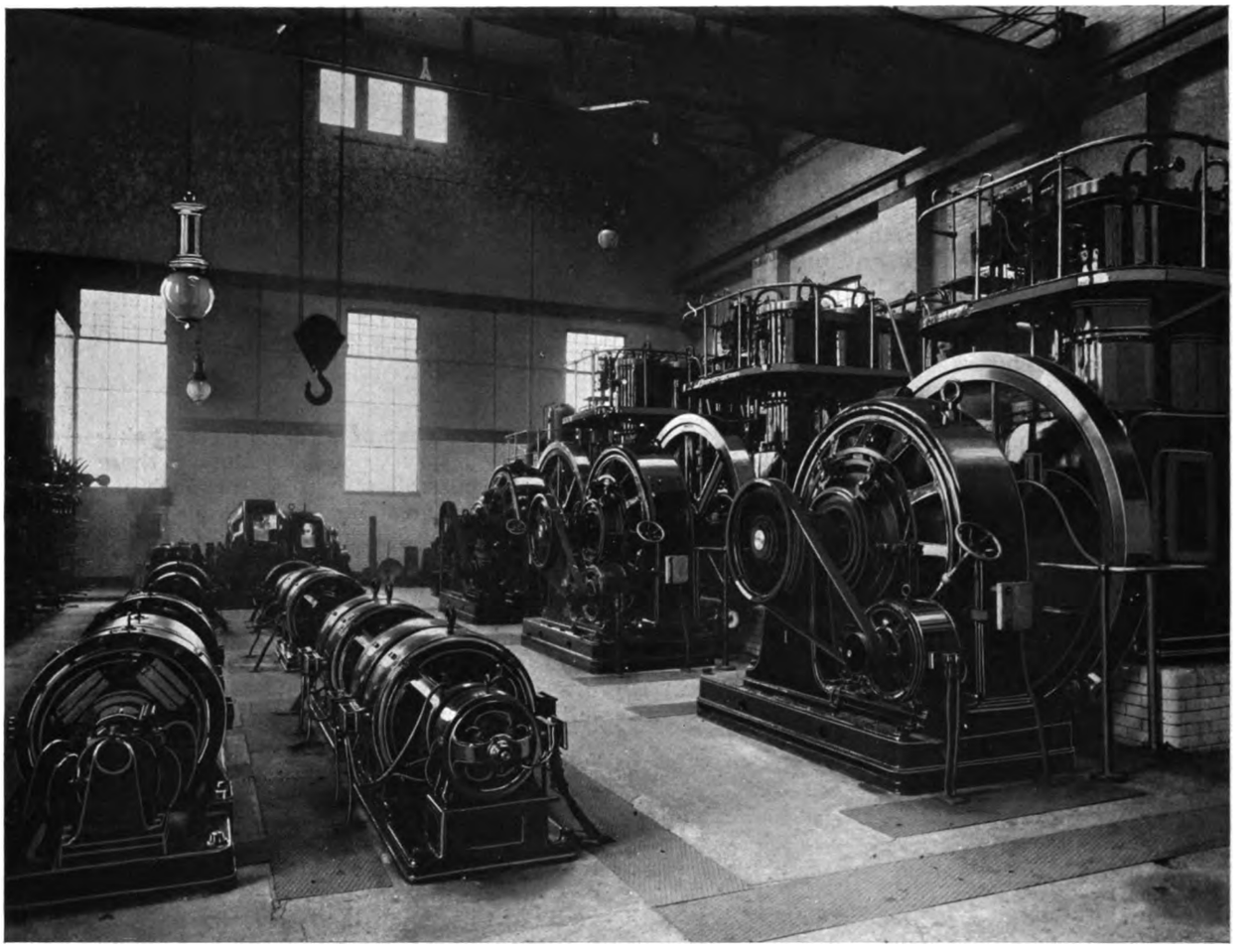
As regards the new machines, the Lancashire Dynamo & Motor Co.'s booster is of the firm's standard three-wire type. With a comparatively low continuous rating it satisfactorily commutates the "peak" discharges up to 750 to 2,000 amps.; and it can be set to make the engines work up to their overloads as above, or to work under practically any other conditions, without any serious drop on the bus-bar voltage.

The Westinghouse Co.'s new generating set is of the firm's latest type of gas engine, being a three-crank engine, with three sets of cylinders, two in tandem in each case. Its speed is 300 r.p.m., and its lubrication is forced. It need only be said here that its design and construction are sound and thoroughly mechanical and its performance so far proves it to be an excellent engine, and one as reliable as any steam engine.

The motor generators used deserve special mention, not only because they form that part of the generating station most directly connected with the traction installation, but because there are many noteworthy points about them. They are in many ways exceptional machines and working under exceptional conditions, bearing the heavily fluctuating nature of the load in mind.

This load indeed varies from nothing to upwards of 1,000 kw. in very short periods. The specification called for the machines to be each capable of a continuous output of 150 to 200 kw. with a temperature rise of 80 degs. Fahr., but they were also called upon to be capable of safely carrying output overloads of 900 kw. instantaneous, 600 kw. for half a minute, 500 kw. for three-quarters of a minute, and 300 kw. for two and a half minutes, and were required to be also tested under a regular cycle of these overloads, with underloads in between, for eight hours. The internal driving losses were also required to be kept down, while on the alternating current side they were required to regulate within 6 per cent. on throwing off a non-inductive load equal to the full continuous load, and within 20 per cent. on throwing off a similar but inductive load of ·8 power factor. Further, they were required, with the assistance of external means, if necessary, to restore the pressure to normal within seven seconds of the coming on or throwing off of loads up to 600 kw. at ·8 power factor, or 300 kw. at power factors down to ·3.



General View of Interior of Heysham Power Station.

Widely varying proposals were received in connection with these machines, those of the Electric Construction Co. being finally selected, their machines being very compact and requiring a small amount of driving current, as well as having a high efficiency.

The makers' specification was 175 kw. on continuous rating, the machines on test being well within the specified temperature rise, but not excessively so. During the running of the trains at Heysham experimentally each of the sets have several times been subjected to loads up to 900 kw. input without the slightest commutator trouble, and smaller overloads of 600 kw., 500 kw., etc., have been very frequent and have been carried with equally satisfactory results.

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The alternating current regulation is also fully up to the specified requirements, and on an average after the switching on or throwing off of a heavy load the voltage is restored to its normal of 6,600 volts within three seconds, while the voltage even then only varies about 300 volts each way; nothing could, indeed, be more satisfactory than the performance of these machines.

The direct-current motor is compound-wound with commutating poles, the series winding being a very slight one, and put in principally to assist the two sets to run in parallel satisfactorily, which they do.

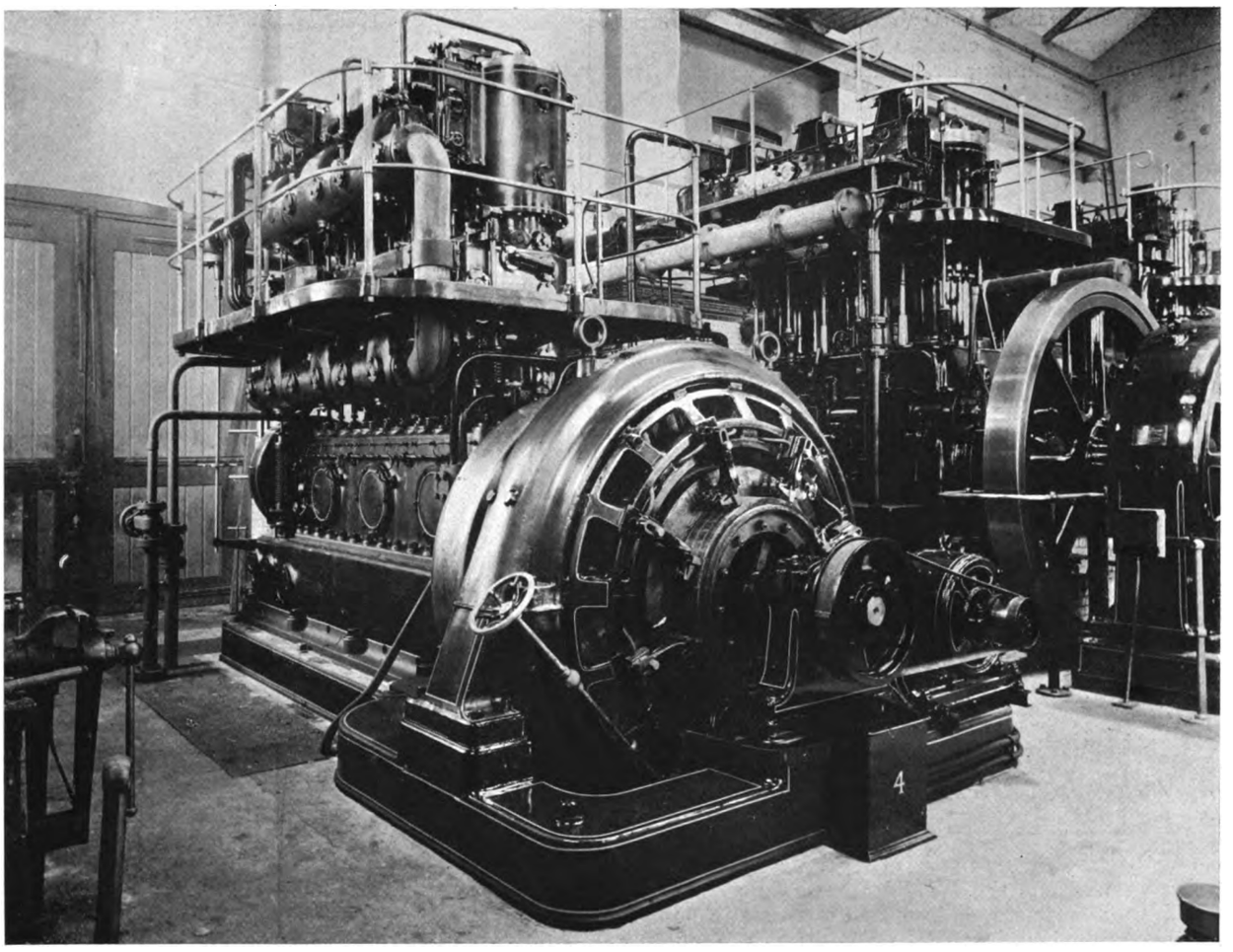
The alternator has a three-phase star winding, so that if one winding breaks down the other two may be used for the single-phase supply, otherwise no use is made of the three-phase connections. The machine is of the standard internal revolving field type, and is excited from an exciter which is carried on the end of the bedplate and spur geared up to about 1,100 revolutions. This exciter has laminated fields and is compound wound, its series winding carrying a portion of the main motor current, so that (so far at least as varying loads of equal power factor are concerned) the tendency of the alternator to drop in volts is thus compensated for.

Compensation for varying power factors is effected by means of a regulator, designed and constructed by the Electric Construction Co., and the first of its kind which inserts or extracts resistance from the circuit of the shunt field of the exciters by the action of solenoids; these solenoids are respectively excited as the voltage exceeds, or is less than, the normal.

The direct motor current armature and the revolving field alternator are carried on the same shaft without any intermediate bearing. There are only two main bearings on the machines, and these are ball-bearings. These bearings have, so far, given every satisfaction, and have proved very advantageous in reducing the starting current, which at 460 volts is only about 750 ampères, and the no-load loss, which is about 23 kw., with the exciter and alternator fully excited.

The switchboard has been designed and constructed by the railway company, the instruments being of the Westinghouse Co.'s make. From the diagram (page 446) it will be seen that each of the motor generators is supplied from the low-tension bus-bars through a no-voltage and overload circuit-breaker. The shunt circuit is excited through a separate double-pole knife switch, with kicking contacts and resistances. Starting resistance is cut out by means of a set of knife switches. By means of a throw-over switch these can be used to start either set of the machines, a heavy triple-bladed knife switch being thrown in finally when the machines are fully started up, connecting them direct to the bus-bars.

On the alternating current side each alternator is connected up to the bus-bars by a hand-operated oil switch, and the current passes from the bus-bar through duplicate automatic circuit-breakers to duplicate feeders passing out to the overhead lines. All the circuit-breakers, both high and low tension, have time-limit devices. The exciter shunt fields of the alternators are also connected through double-pole switches with non-inductive contacts and resist-



Westinghouse Six-Cylinder Gas Engine and Dynamo.

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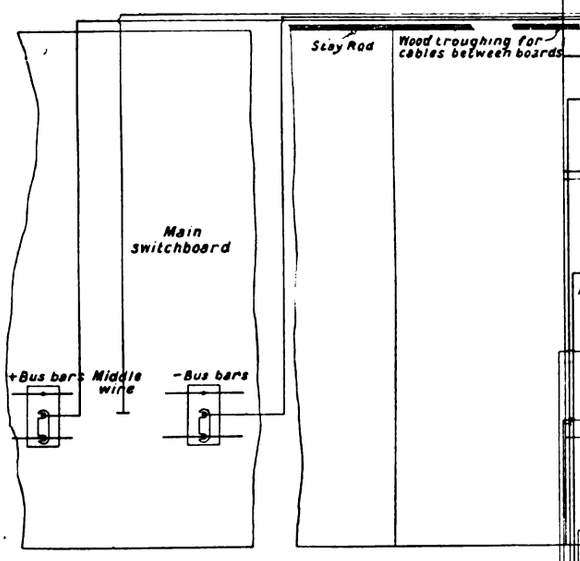
ances. The instruments used consist of an ammeter on each of the direct-current motor circuits, and a voltmeter, ammeter, and watt-hour meter on each of the alternator circuits, all, of course, operated through transformers. The incoming wire from the rails is, of course, at "earth" potential. There is also an indicating watt-meter between the bus-bars and the outgoing feeders, and the regulator is connected to the same transformer.

The high-tension apparatus is contained in a lock-fast expanded metal chamber placed over and at the back of the actual switchboard, the switches being operated from the handles of the latter through rodding. The door of the high-tension chamber is interlocked with the holding-up coil of the motor circuit-breakers, so that unless the door is closed neither motor generator set can be started, while if it is opened during running everything stops.

ROLLING STOCK.

The rolling stock, built by the railway company, consists of three trains, there being three motor cars, two with equipments by Siemens Brothers and one equipped by the Westinghouse Co. The determining cause of the order being thus divided was purely that Messrs. Siemens were supplying all-



electric control, which was preferred by the railway company, whereas the Westinghouse Company preferred to adhere to their electro-pneumatic control apparatus; otherwise the proposals were equally acceptable. In addition to the motor cars, four trailer cars have been specially built, while one or more old bogie coaches will be utilised for carrying workmen, luggage, etc., particularly between Morecambe and Heysham. Each end of each of the trailers and of the motor cars is equipped with driving apparatus, this being necessary as the trains will vary considerably in length owing to the traffic being very variable from season to season, and also, as the coaches are liable to reversal in the way they head, owing to the triangular junction, near one apex of which Morecambe Station lies.

It will be seen from the map that the distance from Heysham to Morecambe is 5 miles and from Morecambe to Lancaster 4 miles. There will be practically no direct running from Heysham to Lancaster. There is also a short extension of about three-quarters of a mile from Lancaster Green Ayre to Lancaster Castle. The distances, except the last mentioned one, have all been increased by about a quarter of a mile since the scheme was decided upon, by the alteration in position of the new station at Morecambe as compared with the old. The service of which the trains are expected to be capable is a 20-minutes continuous service between Heysham and Morecambe, and a 15-minutes service between Morecambe and Lancaster, using a single train in each case. The trains will, however, not be worked up to anything like this service throughout the day.

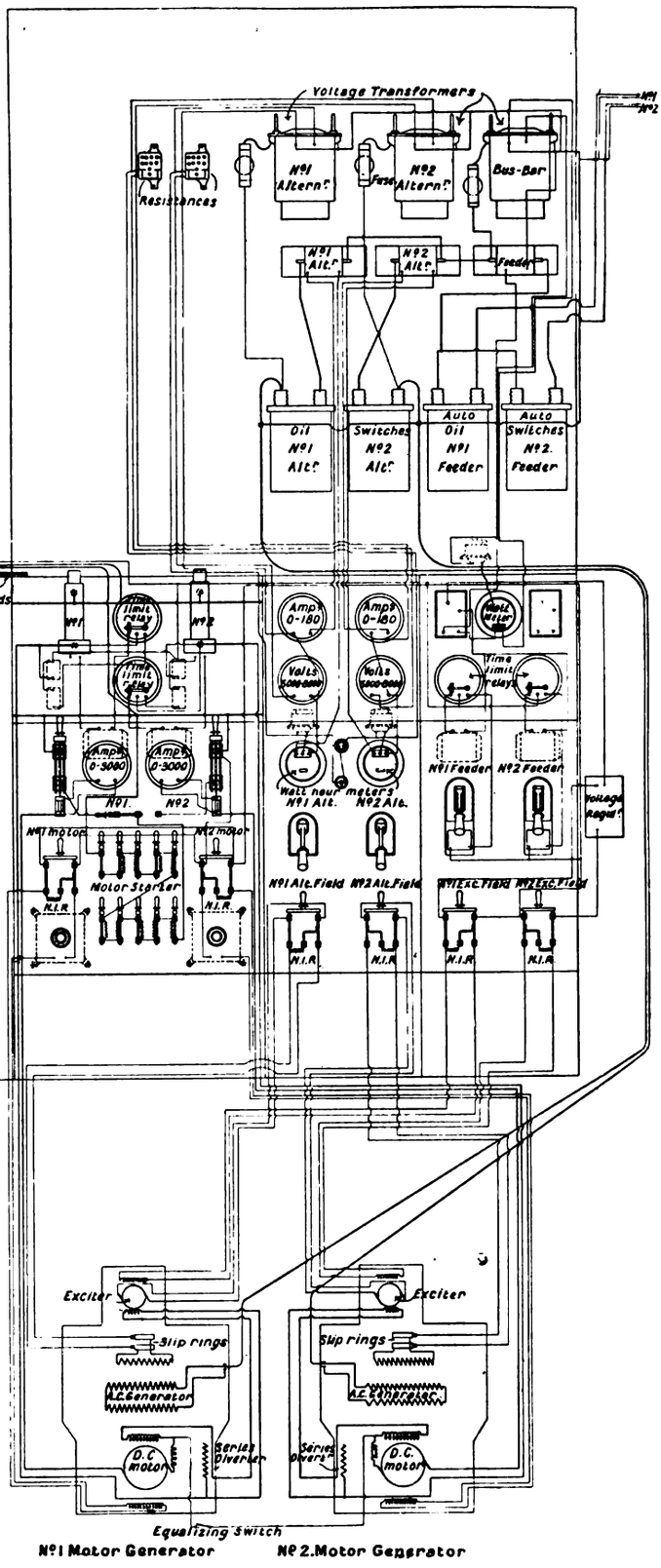


Diagram of Traction Board Connections.

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There are no gradients of any importance on any section of the line except between the two Lancaster stations. There are, however, a number of speed restrictions near each of the three terminals of the line.

The motor cars are of the open central corridor type, and have a total length over end panels of 60 ft., and an extreme width of 9 ft.; there are three compartments with a total seating capacity of seventy-two passengers, the vestibule compartment at each end being reserved for the accommodation of driver and guard. Of the passenger compartments, the middle one with a length of 25 ft. has the seats arranged transversely, while the other two compartments, each 13 ft. 5 in. long, have longitudinal seats to allow of trap doors in the floor for easy access to the motors, etc. The rolling stock has been built by the Midland Railway Company in the carriage and wagon shops at Derby to the designs of Mr. D. Bain.

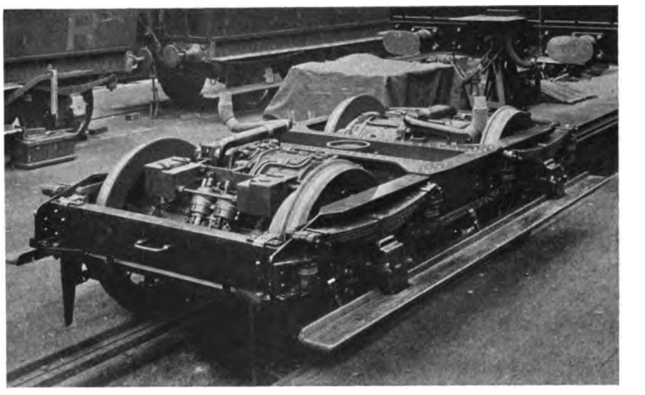
Efficient ventilation is provided by means of drop lights in the upper part of the side windows, and "torpedo" air extractors in the roof.

The lighting of the cars is from the power current throughout; the motor cars are also electrically heated from the same source, but the trailers have not yet been fitted with heaters, as their extensive use during the winter months is not anticipated. The interior finishing and decorating has been carried out with regard to facility in keeping the cars clean; the roof is covered with millboard and painted white; the cabinet work is of polished oak, and the seats are covered with perforated sycamore.

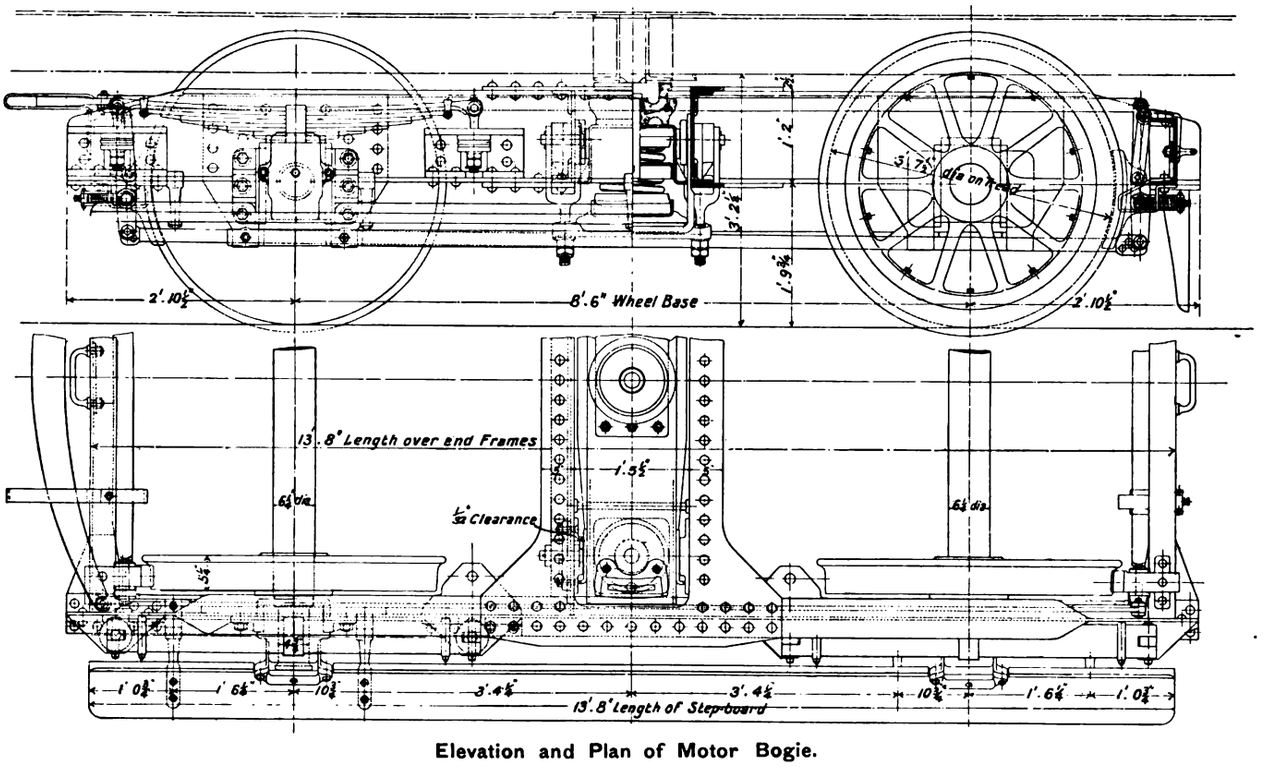
The underframe is constructed of Z and channel section steel, with angle knees and gusset plates, and well supported with truss rods to sustain the electrical equipment. The trailing bogie is of the Midland Railway Company's standard type, composed of pressed steel members. The wheel base is 8 ft., and the wheels are 3 ft. 7½ in. diameter on tread.

All the cars, both motor and trailer, are fitted with both hand and power brakes, under easy control of the driver, who can work at either end of the vehicle. The power brake is of the vacuum type obtained by pumps driven from independent motors, and each trailing bogie wheel is braked on both sides.

The trailer cars have a length over end panels of 43 ft., and an extreme width of 9 ft.; they consist of one long compartment with a driver's vestibule at each end. The seats are placed transversely throughout, and will accommodate 56 passengers. The interior finish, ventilation and lighting is similar to that of the motor cars. The underframing is of light construction as it has no electrical equipment to sustain; but the two bogies are interchangeable with the trailing bogie of the motor car, with the exception of the springs which are of lighter construction.



Motor Bogie.



Elevation and Plan of Motor Bogie.

The motor bogies were constructed by the company's locomotive department, and owing to the small number required have been specially built up of rolled sections and plates. The axles are of forged steel 6½ in. in diameter parallel between the wheels and reduced to 4¾ in. in the axle bearing, the length of the journal being 9 in.

The wheel base is 8 ft. 6 in., and the driving wheels

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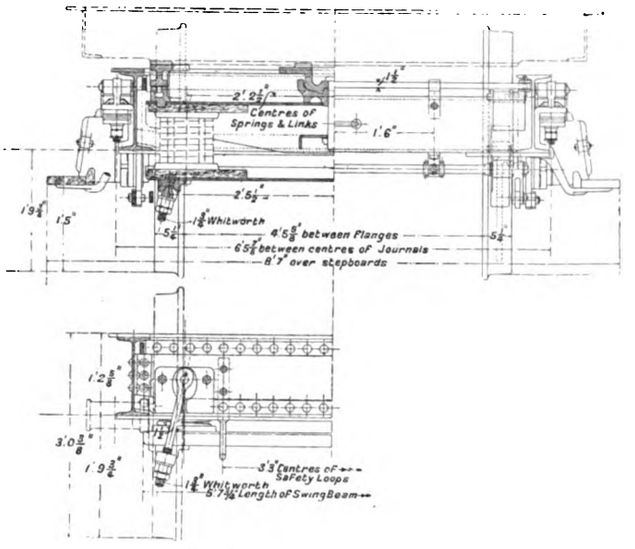
are 3 ft. 7½ in. in diameter on the tread when new. As only a few cast-steel wheels were required, an existing tender wheel pattern was made use of for the wheel centre, and consequently the wheels are considerably heavier than is really necessary. The



Section of Motor Bogie.

centres are of cast steel and the tyres of mild steel, ordinary rolled tyre section; in fact, the wheels are practically standard tender wheels. The tyres are 5¼ in. wide, and are shrunk on the centre and held by screws through its rim.

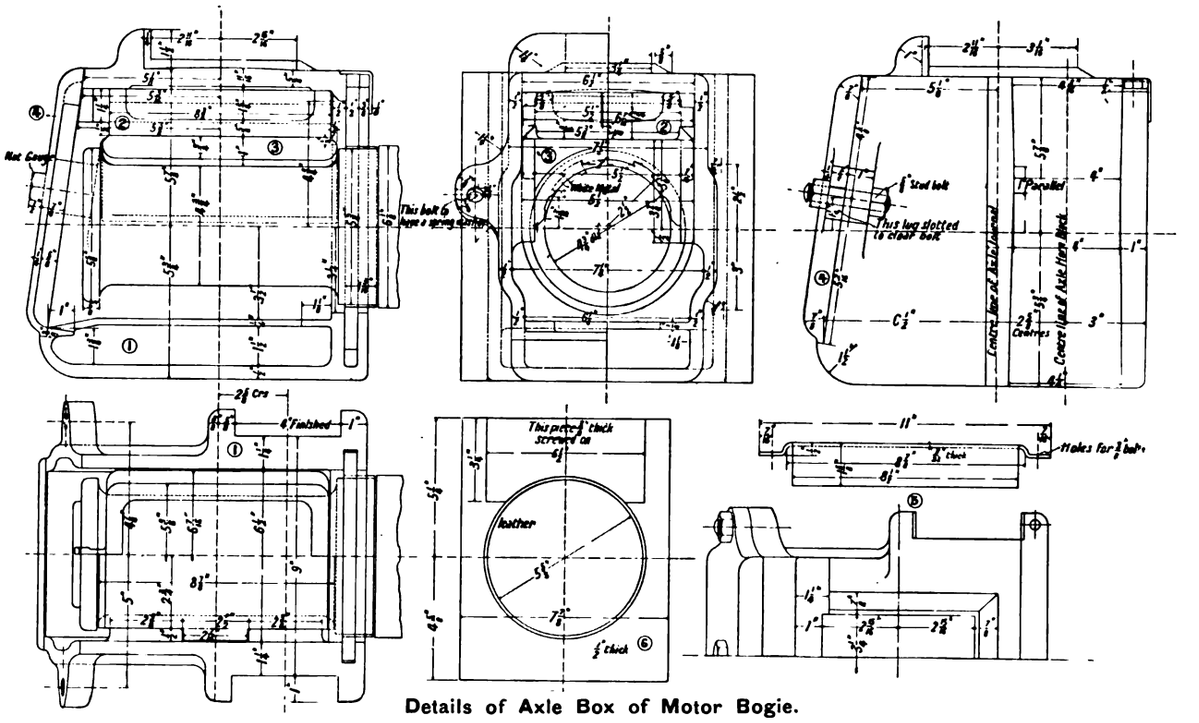
As will be seen from the drawing (pages 447–8), the steel side frames are of rolled joist section 14 in. by 6 in., the end frame being 10 ft. by 4 in. channels, and the transom, or centre cross-frame, being built up of plates and angles. It is of box section, the bolster lying inside between the webs. The top plate and gussets on both sides of the centre pin are in this case in one complete piece slotted out of the solid. The bottom plates are, as usual, in two pieces, one on each side of the centre, the gusset plate being combined with the cross-flange in this case also.

Owing to the necessary length of bolster being too great to get in between the flanges of the side frames, a certain amount had to be cut from the inside of the top flanges of these, and as this necessitated doubling plates on the top of these flanges and their combination with the top flanges of the centre cross-frame, the making of the top plate in one piece, as above described, followed naturally; incidentally this construction gives a very stiff and rigid backbone to the bogie. The swinging bolster is of pressed steel, and is similar to that of the trailing bogie, except for the heavier springs.

The axle boxes are of a special pattern built for these bogies, though they are very similar to the standard carriage axle boxes suitably altered to act as driving boxes. Their construction is shown on this page, and it will be seen that the brasses, which are white-metalled, subtend a slightly larger angle than the usual carriage brass, being about the same angle as locomotive brasses. Lubrication is effected entirely from the pad at the bottom, supplied from the usual oil well, the brasses being well chamfered away at each side so as to ensure an ample feed of oil into the journal and its formation into a proper lubricating film. The top of the box casting forms a seating for the ordinary laminated steel-bearing springs. The horn blocks are cast steel, bolted with the usual fitted bolts to the framing.

The box is, of course, a good sliding fit in the blocks longitudinally, but across, *i.e.* lengthwise of the axle, it only actually fits the blocks a distance of about 1½ in. at a point opposite to the centre of the bearing area, being tapered out the remainder of its length both ways to the extent of about ⅛ in., this obviating any tendency for the axle to be nipped during running at the throat of the journal. The bearing springs are laminated steel plate springs, such as ordinarily used for this purpose, but considerably heavier than the standard carriage springs of ordinary type.

The brakes, as is usual in electric motor trucks, act



Details of Axle Box of Motor Bogie.

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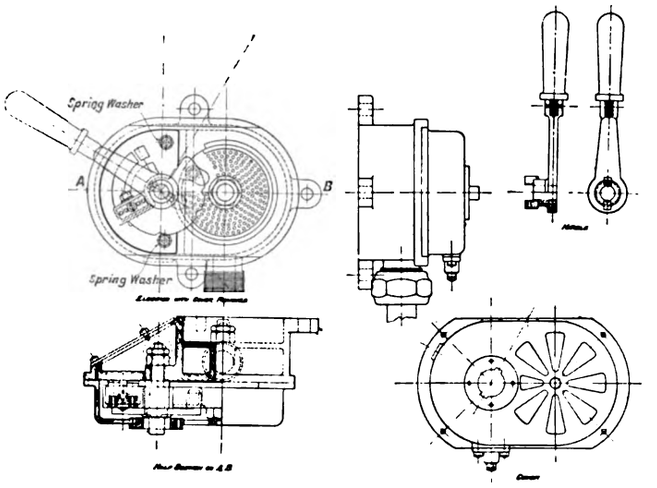
only on one side of the wheels, lack of space making it impossible to adopt the standard railway practice of two brake blocks per wheel. The blocks are hung from brackets on the bogie end frames, and are actuated by levers connected to bars running lengthwise under the inside top flange of the side frames. An arc-shaped cross-bar connects these bars together and is coupled to the brake pull-rod through a shackle



Arrangement of Switch and Valve for Vacuum Brake.

and roller arrangement, which allows for the swivelling of the bogie on curves without affecting the brake gear adjustment. The weight of the whole bogie is 6 tons, the extra weight of the wheels, however, accounting for about 1 ton of this.

Before going on to deal with the actual driving equipment of the cars, the other accessory apparatus, which may be of interest, may be shortly described.

Each motor car has two brake cylinders, that for the motor bogie having special levers giving the cylinder greater purchase than usual. The trailer cars have only a single brake cylinder, operating brakes on both bogies.

The vacuum is obtained from a Gresham & Craven vacuum pump supplied through the electrical equipment contractors, Messrs. Siemens Brothers, by the Vacuum Brake Company. The pump is motor driven with a worm speed reduction running in an oil bath. A single brake pump is used on each motor car.

The control gear for the pumps is arranged so as to give a high speed and a low speed, the latter being one-fourth of the higher. The pump runs at the low speed throughout the operation of the train, and whether the brakes are being applied or not, excepting when put on to the high speed in order to take off the brakes rapidly. The action thus corresponds exactly with the operation of the large and small ejectors on a locomotive.

The pump control gear has been specially arranged with a view to making it practically impossible for a train to be moved without proper vacuum having first been obtained, the arrangement being as follows.

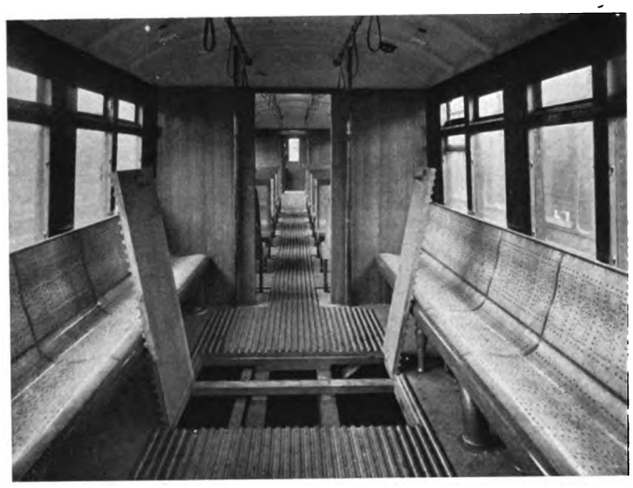
The driver's brake-valve is of special construction as shown on this page, and is combined with a switch which operates the contactors controlling the pump. Current is fed up to this switch through one contact of a three-way plug, of which one of the remaining contacts is the feed wire from the auxiliary transformer, and the third goes to the master controller. It is therefore impossible to move the car by means of any of the controllers unless this plug is inserted, and its insertion automatically operates one of the pump contactors, and starts it working at either the high or the low speed; most probably the former, as the driver's brake-valve handle is removable, but can only be removed in full pump speed position. The use of this plug also ensures that only one controller throughout the train can be used at a time.

There is, of course, a driver's brake-valve in every driving compartment, but it will be clear that only the valve and switch in that compartment which is being used for driving, and in which the driving feed plug is inserted, is operative for starting and varying the speed of the pump, but the brake can be applied by the guard or other authorised person who is in possession of a handle at either end of every coach.

There is also fitted to each motor car an additional switch controlled by the vacuum, which will trip the main circuit-breaker in the event of the vacuum falling below about 15 in., this being decided upon principally in connection with emergency applications of the brake by a guard who will thus be given full control over the train—an advantage, seeing that there is only one motorman. This switch also ensures that motormen cannot start the train before taking off their brakes.

A horn, which takes the place of a locomotive steam whistle, is carried on each end of each motor car, and is electrically operated, the sound being produced by the vibration of a diaphragm by means of apparatus similar to but of greater power and more substantial construction than the ordinary trembling bell, a surprisingly loud and clear note being obtained in this way. The sound is multiplied considerably by use of properly designed trumpets obtained from Messrs. Boosey & Co., and a very satisfactory sound is produced at an expenditure of far less power and much less complication than would be the case with a vacuum-operated horn; in fact, the electric horn compares well with a horn operated by compressed air, which was not available on these cars.

The vibrators were supplied by Messrs. Marples



Open Trap-Doors over the Motor Bogie.

Leach & Co., and are operated by a small 12-volt set of secondary batteries, the train wire for operating them being carried through the train in the ordinary train cable and through the jumpers.

The lighting is carried out by groups of six 24-volt lamps in series from the 150-volt auxiliary transformer control main.

The two side tail lights, however, which are electric, are each direct on the 150-volt mains, the lamps being carried inside ordinary tail-lamp lanterns which are detachable and carry an ordinary watertight plug, the socket being fixed on the end of the

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coach, just above the lamp iron. Lamp irons, plugs, and plug sockets are provided at each end of each coach.

The lamp in the driver's compartment is specially shaded so as to throw only a narrow beam of light on the vacuum gauge and ammeter, thus allowing the driver to get a good view of the road outside, his compartment being practically dark. The shade is arranged so as to be opened when occupied as a guard's and luggage compartment or as an entrance vestibule.

The window on the left or near side of the train is that through which the driver views the road and, in order to clear the outside of this window from snow and rain, a special scraper has been arranged with a handle inside the compartment so that by throwing this handle up and down the window is cleared. The scraper consists of a squeegee made of flat rubber on edge.

ELECTRIC EQUIPMENT OF CARS.

The driving equipment of two of the motor cars has been supplied by Messrs. Siemens Brothers Dynamo Works, of London and Stafford, and of the third by the British Westinghouse Co. The specification of the equipments called for two motors per car, both to be carried on one bogie, it being considered both the more economical and the more mechanical arrangement to concentrate the motor power and reduce the number of parts as much as possible, while with single-phase traction and voltage step control there is, of course, no necessity to consider series-paralleling.

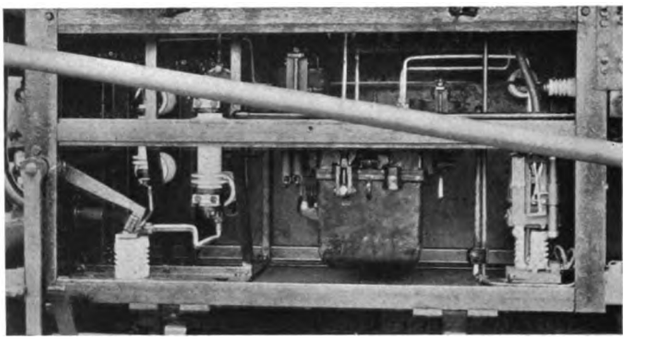
The running conditions will be seen from the profile of the line on page 439. The normal train was specified to consist of a motor car and two trailers, the weight of these being, without any of the electric apparatus or the mountings for the same, 25 tons for the motor car and 17½ tons for each of the trailers; the motor car seating 72 passengers and the trailers 54, the respective standing capacity being 58 and 36, giving a total maximum capacity, without encroaching on the vestibules, of 310, with a total of 180 seats. As has been already noted, the trailers are considerably shorter than the motor cars.

As has been mentioned, since the original specification was issued a quarter of a mile has been added to the respective lengths between stations, owing to the moving of Morecambe Station. The original position of the station for which the specification was issued is marked with an "X" in the plan on page 439. It was specified to the contractors that they would be permitted to run at 25 miles per hour round the speed-restricted curves, and on this basis the trains were to be capable of working a 20-minutes service from either end as between Heysham and Morecambe with a single train, and a 15-minutes service as between Morcambe and Lancaster under similar conditions.

The capacity of the motor car was to be such as to enable it to take on occasions two additional main line coaches weighing 26 tons each, and was also to be capable of climbing with its train the gradient from Lancaster Green Ayre to Lancaster Castle occasionally. The additional length to Morecambe can probably still be covered for the 20-minutes service if the cars be run at 25 miles per hour round the curves at the cost of a rather greater consumption of energy.

The specification also called upon the contractors, should the order for the coaches be divided, to make their equipments capable of being worked from the same master controllers, and though considerable difficulty had to be got over in order to meet this condition it was found possible to work the Siemens equipments in conjunction with the Westinghouse one in this way.

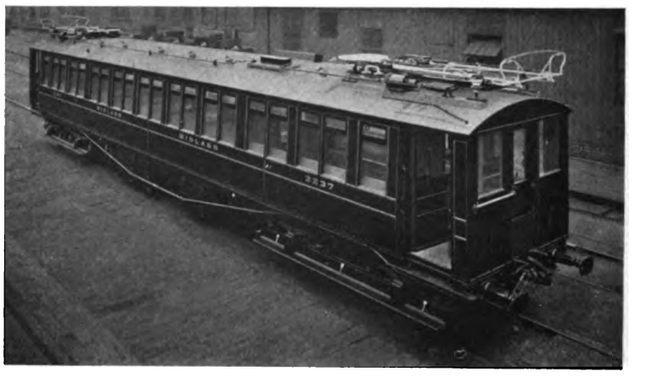
It was considered by the railway company that two 150 h.p. motors per motor coach would satisfactorily carry out the work, and the respective contractors supplied motors of their nearest standard sizes to this, the Siemens motors being nominally of 180 h.p. and the Westinghouse motors of 150 h.p. The specification called for the motors being capable of delivering, when tested on the stand with single-phase alternating current of the proper periodicity,



Siemens High-Tension Chambers Open.

their declared output for one hour with a temperature rise not exceeding 135 deg. Fahr., and they were also required to have a temperature rise not exceeding 90 deg. Fahr. on any portion after having run the three-coach train for six double trips as per the schedule above mentioned from Heysham to Morecambe, Morecambe to Lancaster, and return. Overload and other similar tests were also specified.

The control gear was specified to be preferably all-electric multiple-unit type. The Westinghouse car has, however, been accepted with their standard electro-pneumatic control modified as necessary to enable it to work with the Siemens car, which is all-electric. Stringent guarantees of efficiency, energy consumption in watt-hours per ton mile, and general performance were required to be given.



Siemens Car, Showing Equipment on Roof.

The main transformer was required to conform to the same test conditions for heating as the motors, an auxiliary transformer being specified to provide for the supply of current for lighting, heating, and working the control apparatus and brake pump, this transformer having a three-hour test specified, as it is subject to continuous working. In later issues we hope to give detailed descriptions of the apparatus with drawings and photographs; but the following general notes will serve to give a general idea of the mechanism. The Siemens cars are provided with

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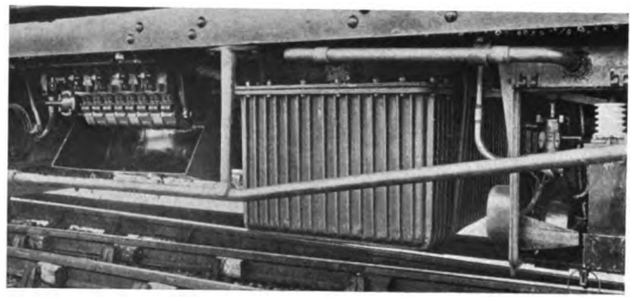
two collector bows, it being considered by the firm best to ensure continuous contact as far as possible. It was found impossible to get the firm's standard bow (which is of inverted pantagraph type) into the restricted space at disposal between the coach-roof and overbridges, and a type of bow has been adopted somewhat similar to the Continental tramway type of bow, but having a small auxiliary bow at the end controlled by parallel motion. This bow, while appearing somewhat simpler than the standard bow and requiring less room and while fairly satisfactory in working, has the disadvantage that it requires balancing by a wind screen. The Westinghouse bow is of their standard pantagraph type, a single bow only being used, and this goes into the available space fairly well. Both makers' bows are purely spring-controlled, so far as their working is concerned. The Siemens bow, however, is lowered by a master spring, which can be thrown out of action by a vacuum cylinder.

The Westinghouse master spring is controlled as regards raising and lowering by compressed air, a special compressor being installed by that company in connection with their control gear. A small hand pump has been installed in each case for raising the bows when first starting out in the morning or at similar times when no compressed air or vacuum is available. The two Siemens bows can be raised or lowered separately, and the vacuum for holding them up is obtained from the train pipe through a ball valve, so that when the brakes are operated the vacuum remains on the bows. All the "live" portions of the collector gear in each case are carried on porcelain insulators.

It may be mentioned in connection with the collector gear that the roofs of all the coaches have been covered with an "earthed" wire netting so as to throw out the station circuit breakers in the event of the overhead wire coming down on the roof. The efficacy of this has been actually and satisfactorily tested in practice. The high-tension wiring on the Westinghouse car is carried in lead-covered cable, which on the roof is protected with a further metal covering.

It is carried down about the centre of the car through a heavy section brass tube, the lead covering of the cable being sweated solid on to this tube at the top. This tubing is, of course, substantially "earthed." The further high-tension wiring to the two transformers on this car is also in lead-covered cable, which again in its turn is protected in metal tubing, both heavily "earthed." The cables are rubber insulated. Except for the short length down through the coach, the high-tension wiring on the Siemens cars is, from the bow down through the high-tension chamber to the main transformer, all bare wire, being carried on porcelain insulators on the coach roof and underneath the coach. The vertical tube through the coach itself is of brass, and in this case made removable, being practically part of the wiring. The cable is paper insulated lead-covered, terminating above and below in bitumen sealing chambers with porcelain insulator terminations. There is about 3/16ths of an inch air space between the lead covering and the inside of the tube. Both lead covering and tube are heavily "earthed." On the Siemens cars the high-tension wire proceeds into the high-tension chamber, the door of which is mechanically interlocked with the bows so that it cannot be opened unless the bows are down. The low-tension wiring, though low voltage, has proved little more difficult to instal than the ordinary 600-volt wiring. Longitudinally it is carried between the two girders forming the centre members of the underframe, and it is supported between these two members in wooden frames spaced about 18 inches apart. The low-tension cables themselves are not carried in metal tubing, as probably eddy current troubles would arise if they were, but they are substantially surrounded with metal, and the coach body and its frames are all covered with sheet iron and asbestos wherever cables are run underneath. Where these cables require to go cross-wise they are carried between the tops of the girders and the floor and spread out fanwise. The train cable is carried along the outside of the coach alongside the sole-bar in a metal tube, being carried round the bends in flexible metallic tubing. The train cable, couplers, and master controllers, for the whole of the motor cars



Westinghouse Apparatus on Underframe.

and trailers, as well as all the pump motors and their control gear, have been supplied by Messrs. Siemens.

The Siemens high-tension apparatus and their contactors are contained in sheet-iron cases, which have been made by the Midland Railway Company. The supporting of these and of the transformers, auxiliary transformer, preventive coil and other apparatus has involved the provision of a good deal of special girder work on the underframe, which has added considerably to the weight of the latter, and which, as the coach had to be proceeded with before the final details of the electric equipments could be decided upon, could be considerably lightened in a future case.

The Westinghouse apparatus is more self-contained, though the supports for it also could probably be arranged at less expense in weight. The respective weights of the two motor coaches are as follows :—

—	Siemens			Westinghouse		
	Tons	*Cwts.*	*Qrs.*	*Tons*	*Cwts.*	*Qrs.*
Carriage body work	13	5	0	13	5	0
Carriage bogie	4	10	0	4	10	0
Special supports	1	6	0		17	0
Motors with gear and gear case	6	5	0	5	11	0
Main transformer	2	14	2	2	11	0
Aux. com. transformer and preventive coil		19	2		9	2
Pumps and compressors		9	2		16	0
Contactors and chambers	1	2	2		9	3
Other sundries, including bows, blowers, controllers, etc.	3	7	0	2	9	3
Motor bogie	6	11	0	6	11	0
	40	10	0	37	10	0

The Siemens equipment consists of the two motors, the main transformer, the auxiliary transformer, preventive coil, and commutating transformer, high-tension circuit-breaker and fuse in the main transformer circuit, high-tension fuse in the auxiliary transformer circuit, contactors, motor fuses, which also act as motor cut-outs, and low-tension fuses in the

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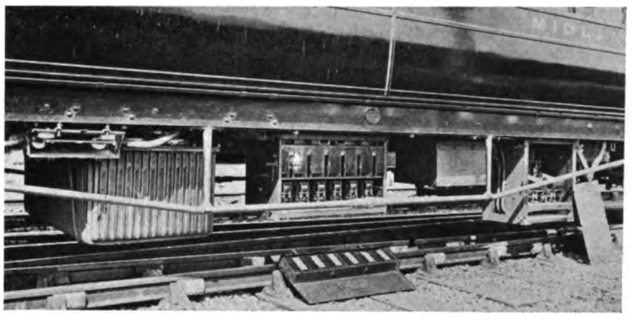
circuit feeding the control, and also a low-tension fuse in the circuit feeding the fan. There is intentionally no fuse placed in the brake-pump main circuits, the cables for which are carried in special heavy section tubing, so that if anything goes wrong on the pumps the main high-tension fuse will be blown, and it will be impossible to work the car.

The apparatus was very stringently tested at the makers' works with results satisfactory in every way. At 180 h.p., and with forced draught, the motors were very much under their guaranteed temperature rise, and did not exceed this temperature rise when tested at this h p. with natural ventilation on the stand. With forced draught, and with only 300 volts on their terminals (the full voltage being 340) they were tested under specified temperature rise at 200 h.p., corresponding at full voltage to fully 225 h p. They were also tested for continuous operation giving at 250 volts, which was chosen as being a mean operating voltage, 105 h.p. for five hours with a



Westinghouse Apparatus with Contactor Chambers Open.

temperature rise of only 115 deg. Fahr., so that at full voltage, allowing nothing for the improved ventilation at the higher speed, the machine can give continuously nearly 150 h.p. The sparking tests were equally satisfactory, there being no objectionable sparking at a current of 1,100 ampères, at 300 volts, which corresponds at full voltage to 350 h.p., and a torque of fully two and a half times that at the rated h.p. of 180.

The commutating transformer, while apparently an additional complication, probably pays its way in effectiveness, as the sparking of these Siemens motors, both on test and during actual running on the line, has proved to be quite as good as that of any, and better than that of many, direct-current traction motors; in fact, during the testing on the line, currents of over 1,000 ampères per motor have been of frequent application, without any demonstration at the commutators, even just at starting, the brushes on the latter portion of the acceleration and during free running being absolutely dark. The operation of the contactors is also perfectly satisfactory, and gives none of the trouble that has been prophesied in various quarters for single-phase contactors in the direction of humming and chattering, excessive size, etc., though they are more liberally designed than will probably be adhered to as standard practice.

The master controllers are, it may be mentioned, of fly-back or dead-man-handle type, being, however, somewhat different from the usual design, inasmuch as the release of forward pressure on the handle by the driver trips the whole of the contactors at once, no matter on what stop the driver may be working at the moment, and without his allowing the handle to come back to the "off" position. This practically ensures the obtaining of the maximum amount of safety that can be obtained from a handle of this type, though the occasional sudden throwing-off of heavy loads in this way is a somewhat severe tax on the regulating properties of the power station.

The Westinghouse equipment consists of motors, transformer, and auxiliary transformer, preventive coil, H.T. circuit breaker in main circuit, fuse in auxiliary H.T. and L.T. circuits, contactors, and control gear. The motors are ordinary straight series compensated without any special commutating device other than the commutator resistance leads, the equipment as a whole being very simple but effective. The commutating performance on the line of these motors is excellent, and also as good as, if not better than, most ordinary heavy D.C. traction motors, while the commutator remains in quite as good running condition as that of any such motor.

The contactors are electro-pneumatically operated, as are also the raising, lowering, and locking gear of the bow, and to supply these parts a small compressor is installed in addition to the vacuum pump. This equipment also was tested at the makers' works with highly satisfactory results, the temperature rise at the end of an hour's full load of 150 h.p. with single-phase current being well within the limit, while overloads up to 1,200 amps., corresponding to 195 h.p. at full voltage and 2¼ times normal full load torque were applied without causing injurious sparking.

On the Westinghouse motor car, No. 2,236, current is conducted by means of a lead-covered rubber insulated cable from the pantagraph bow collector on the roof through a heavy brass conduit to the main circuit breaker. This circuit breaker is electro-pneumatically operated and breaks contact under oil. It opens automatically on overload, and is closed again from the driver's cabin by moving the master controller to the first notch. The current then passes to the high tension end of an oil insulated self-cooling auto-transformer, the other end of the winding of the transformer being securely earthed. The low tension tappings from this transformer are connected to the six switches forming the electro-pneumatic switch group. The switch group measures only 43¼ ins. by 24½ ins. by 23 ins. and weighs 845 lbs. The switches have electric interlocks which ensure their closing in the proper sequence. Powerful magnetic blow-out coils are fitted between each pair of switches which effectually destroy the arc made on breaking the heavy currents. From the electro-pneumatic switch group the current passes to the two terminals of the preventive coil, from the centre point of which the lead to the reverser is taken. The reverser is of the drum type and is electro-pneumatically operated. The magnet valves on the reverser are interlocked with those on the main switch group, so that it is impossible to close any of the switches in the latter until the reverser is set in the right position. Cut-out switches are fitted in the reverser case so that either of the two motors may be disconnected if desired. The motors are of the Westinghouse Company's series compensated type arranged for forced ventilation. This motor has six poles and six sets of brushes. The field core is made up of laminations having six inwardly projecting poles and being enclosed in a cast steel shell. Each pole is surrounded by a former wound field coil which can be readily removed if required. Semi-closed slots in the pole faces are provided for carrying the compensating winding which is connected in series with the armature. Air is admitted to the motor for forced ventilation at openings over the pinion end, and passes through the motor and out through the perforated commutator cover. This method of cooling the motors, which

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was first introduced by the Westinghouse Company on the Metropolitan Railway, has proved very effective in service and materially increases the capacity of the machine. With the construction adopted by the Westinghouse Company it is not necessary to have any system of forced lubrication, both the armatures and axle bearings being equipped with simple oil and pad lubrication.

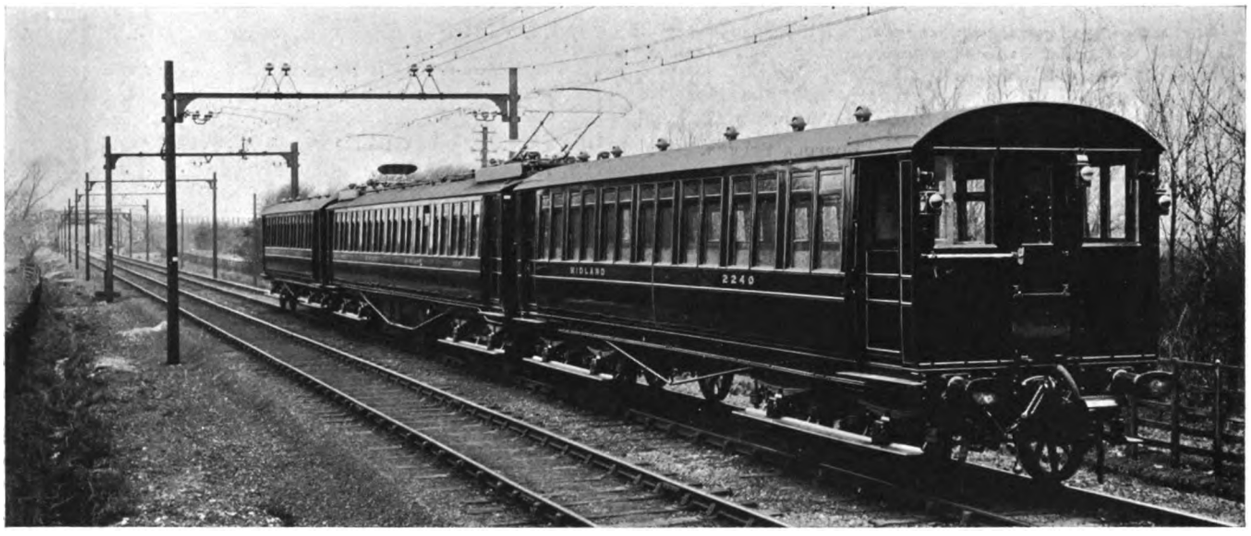
The above equipment was designed for operating in regular service a train weighing 82 tons including passengers. Owing, however, to the sound mechanical construction of the motors and their large overload capacity, it has been possible to operate much heavier trains than this. A train made up of seven ordinary vehicles and this motor car, giving a total weight of 161 tons, has been run between Lancaster and Morecambe. On starting with this load each motor takes about 1,050 amps., and this current is commutated quite satisfactorily without the motor showing any signs of distress. The train accelerated rapidly and smoothly, reaching a speed of about 50 miles an hour.

The other general points are as follows:

The forced ventilation for the motors of both sets of cars has been fairly simple to arrange. For the Siemens car the suction duct has been carried inside the car under one of the seats, the whole of the air coming in this case from the inside of the car. The Westinghouse car has a similar duct inside, but as more air is required for their motors they have also a suction duct with a filter taking air from the outside of the car. In both cases this duct comes direct into the suction eye of the fan, and the delivery duct after leaving the fan splits into two pipes, one of which crosses to the other side of the coach and comes up under the longitudinal seat on that side, thus getting across the cross-member of the underframe, and coming down again above the motor, to which the air then proceeds through a rubber concertina pipe. The other half of the duct proceeds direct up under the longitudinal seat on its own side, coming down in a similar way to the other motor. The auxiliary transformer was adopted chiefly at the instance of Messrs. Siemens with a view partly to better suiting their control gear and partly to obviating any possibility of the lights in the coaches being put out by the coming out of the overload circuit-breaker in the H.T. circuit, or by any other accident which would cut off supply from the main transformer. Also, during a great portion of the year the cars will be lying in the stations for long intervals between running, and an appreciable saving of energy will be effected by doing away during such stoppages with the magnetisation losses of the large transformer. On the Westinghouse car, however, at the instance of that company, the main transformer is kept continuously energised, except when the main circuit-breaker comes out on overload. The auxiliary transformer might, however, be dispensed with in cases where the cars are in continuous service.

On the Westinghouse car there is no interlocking of the high-tension chamber with the bow, the high-tension circuit-breaker and fuse being put in lockfast cases, the keys of which are kept at headquarters.

The performance of the motors of these three cars, both on the test bed and on the line, suffices to disprove the assertion made against single-phase motors of excessive and injurious sparking. It may also be mentioned that in a test with a two-car train, weighing approximately 58 tons, made incidentally in the course of ordinary running, one of the Siemens cars attained speeds of 30 miles per hour in 41 seconds, 48 miles per hour in 80 seconds, and the free running speed of 60 miles per hour in 160 seconds, starting, and running for 440 yards after starting, on an up-grade of 1 in 200, there being, however, thereafter about 100 yards of level, and then a down grade of 1 in 500 for 1½ miles. This portion of the line is very considerably curved, and has curves of 30 and 40 chains radius.



Three-Coach Train on the Line at a Section.

These tests are not the most favourable that could be obtained, as the motors were not being worked to their utmost capacity. If analysed, bearing in mind that the machines are geared for "free running" at 60 miles per hour, and remembering the high train resistance at this speed, this test shows the accelerating power of the equipments to be very satisfactory.

The general scheme for the electrification, the equipment of the power-station, and the driving equipments of the rolling stock, were originated and planned by Mr. R. M. Deeley, locomotive superintendent of the Midland Railway Company, and his assistant, Mr. J. Dalziel. The carriages are, as has already been mentioned, to the design of Mr. D. Bain, carriage and wagon superintendent of the Midland Railway Company, who has been assisted by Mr. P. Ellis, carriage and wagon department chief draughtsman.

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THE

Tramway and Railway World

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We shall be pleased to receive at all times articles, papers, notes, and correspondence on subjects of interest to those concerned in the financial administration, construction, or management of tramway and light railway undertakings. Particulars as to the issue of specifications, the progress and completion of contracts for new work, and suggestions for improvements in all branches of tramway enterprise will receive special attention.

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LONDON, JUNE 4, 1908.

Foreign v. British Rails.

In referring to the question of foreign *v.* British rails in a recent issue, we intimated that for the present, at all events, the London County Council would accept no more foreign tenders for rails. The complaint made two years ago, when an order was sent abroad, was so well founded and arose so clearly from the unfair conditions in which the British manufacturer was placed, that any repetition of the occurrence was indeed well nigh impossible. This did not, however, prevent a good deal of time being devoted to the subject at the meeting of the Council on May 26, although on this occasion the circumstances were more favourable to the home manufacturer. The Highways Committee recommended the acceptance of an English tender for 5,000 tons of English-made rails at £34,640, though there were four lower tenders for rails made in Belgium and Germany, and though the difference between the lowest and the English tender was £2,542. The members of the political party which used to be in power on the Council violently denounced the Committee's proposal, and contended that the lowest tender should be accepted. They are thus unrepentant. The Committee in their report pointed out that in past cases where tramway materials had been obtained from abroad, delay has arisen. In the case of one of the foreign tenders there would have been additional cost for inspection. Further, in November last the Council passed a resolution instructing committees to give a preference, wherever possible, in the purchase of manufactured articles to goods made in the United Kingdom. These are, no doubt, very good reasons, and the Committee's proposal was carried by a majority, but the Committee made no reference in their report to what is the best reason of all for the course they have pursued. It is specifically provided in contracts made by the Council that the contractors must pay to the men employed in the manufacture of the goods the trade union rates of wages recognised in the district, and observe the trade union hours of labour. On the Continent, speaking generally, the wages are lower and the hours are longer than in this country, so that competition unfair to the British manufacturer is introduced. Moreover, there is no ready means of seeing that the foreign manufacturer observes the rates of pay and hours of work which are recognised generally in his own country. To award contracts to foreign manufacturers in such circumstances is simply a form of protection to the foreigner against the British manufacturer. Merely to state the fact is to show that it is intolerable. Councillors who want in all cases to accept the lowest tenders should start an agitation for removing the "fair wages clause" from the contract. Though that would make their position intelligible, we do not expect to see any such action; it would offend the London working man, and for the working man in the rail-producing districts of England the "progressive" county councillor does not care.

Rating of Light Railways.

After a prolonged period of litigation, the question of the basis on which light railways are to be rated has at length been finally decided. On May 8

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the House of Lords, affirming the view of the Courts below, laid it down, in the case of Wakefield Corporation *v.* Wakefield and District Light Railways Company, that a light railway is to be assessed on only one-fourth of its annual value. So far as light railways constructed on private land are concerned, no dispute would probably ever have arisen; obviously, they are in the same category as heavy steam railways, which, under the express provisions of the Public Health Act of 1875, are always rated on one-fourth of their annual value. But since ingenious promoters found that electric lines laid on streets and roads could be authorised under the Light Railways Act, a new set of circumstances has arisen. These light railways, as in the Wakefield case, are indistinguishable from electric tramways; in construction, equipment, and operation they are identical. But if a line of the sort is authorised by Act of Parliament as a tramway, it is called a tramway, and is rated on its full annual value. The Light Railways Act lays it down that any line constructed under powers granted by a Light Railway Order is a railway, that all the railway enactments (with certain specified exceptions) are to apply to it, and that the Order authorising it is to be deemed a special Act of Parliament. The fact that when the Light Railways Act was passed it was not contemplated by the Legislature that street lines would be constructed under its authority does not affect the explicit provisions noted above. One crucial point remained. The Public Health Act states that the land occupied must be used only as a railway. The rating authorities based themselves on the fact that the land occupied by a light railway laid on a street is not used only as a railway, because the general public use it also. The Lord Chancellor and his noble and learned colleagues, however, affirmed the view that the user referred to is the user by the occupier who is rated. There is no question that the land is used by the light railway company only as a railway. The conclusion is certainly curious, and it ought to be a factor in encouraging the promotion of light railways of an interurban type on roads in rural districts. If agitation arises for a change in the law, it may be met by a counter-agitation to put lines authorised as tramways in the same favourable position as regards rating as light railways.

Tramway Motor Gears.

Early electric cars exhibited many crudities of design and workmanship, nor are all the bad points yet eliminated. Motor gearing may be considered as an illustration of the survival of unfitness. Everyone knows that gear wheels are supposed to be designed to withstand two principal actions which produce wear or fracture. In the first place, the wheel teeth are supposed to bear upon the full breadth of their faces. If they do not so bear evenly, then their wearing faces are theoretically reduced to nothing. A gear wheel tooth in good order must bear on its fellow either the full breadth of its face, or only on one end. If a gear wheel has not a perfect bearing, it would last as long if one inch wide as it would if six inches wide. The second action which a tooth is supposed to be strong enough to withstand is the concentration of all the working pressure on the extreme top corner of the teeth. If a tooth breaks under this stress it will break off approximately at an angle of 45 degrees, and no wheel is stronger than what is represented by the stress necessary to break it across the corner of a tooth. In the ordinary system of gearing a car motor, nothing is done either to maintain wear across the whole face or to keep the pressure off the salient corners of the teeth. The gear pinion is placed at one end only of the armature spindle, and the working pressure comes almost entirely upon one bearing. The result is that the gears wear at one end, and often teeth may be found one end of which has worn to a sharp edge, whilst the other end is almost untouched. This, of course, is due to the wear of the bearings allowing the spindle to slope at an angle in place of being parallel with the axle. The teeth do not often break, and this fact simply shows that they are very strong, for they carry all their load on the one corner. Obviously, in place of being 4½ or 5 inches wide, they might just as well be of half that width, for they would be equally strong under the conditions of working. Let the gears be halved in breadth, and let a pair of gears be placed at each end of the armature spindle. The bearing of the teeth would be level, and there would be no corner pressure on the teeth. The full durability of the gears would be secured, for pressure would be even across the full face of two narrow wheels, jointly equal to the old

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double breadth wheels. Each armature bearing could then be made the same length, and one pattern of "brass" would suffice. The pressure on the bearings would be level, and there would not be the present concentration of wear at one end only of each "brass." The space occupied would not be increased, for better wear would be secured even if the joint width of the two gears was less than the breadth of the single narrow gear. Incidentally, of course, there is the additional advantage that the main axle would not be called on to transmit the tractive effort of one wheel through its central body, and there would be less risk of producing rail corrugation. Probably better results would be secured if the teeth of the gears were made of less length radially. With a pair of wheels evenly loaded, the noise of a car would be very much diminished, an advantage that should by no means be overlooked.

CALCULATING DEPRECIATION.

By R. W. Western.

There are just now a number of persons connected with tramway enterprises who are much occupied with questions of depreciation of structures and plant. In considering the several methods of allowing for depreciation, and their effect at different rates per cent. for varying terms of years, it is very inconvenient and cumbersome to be obliged always to be turning over the leaves of tables prepared by actuaries, and it is a great help to be able to command the results, approximately, by the application of a simple rule or formula that can be worked out in the head. For the accountant the use of the tables is imperative in order that the books may be kept accurately; but for the purpose of a preliminary survey by a director, manager, or engineer, the data at his disposal are far too vague to require mathematic exactness in his calculation.

It is therefore useful to remember that the number 72 divided by the rate per cent. at which depreciation is allowed, gives the number of years in which the first cost will be reduced to one-half. This applies to all cases in which the rate per cent. of depreciation allowed is written off the book value. Thus, if 5 per cent. be annually written off the book value of a tramcar, it will stand in the books at half its first cost in a little over fourteen years.

If the rate of writing off be 6 per cent., the time will be close upon twelve years. In other words—

$$ni = 72, \text{ approximately,}$$

where i is the rate per cent. and n the number of years. Of this most people are aware, but perhaps the ground on which it rests is not so well known.

Beginning with a sum which is unity, after one year it becomes:

$$1 + \frac{i}{100}$$

after two years $$\left(1 + \frac{i}{100}\right)\left(1 + \frac{i}{100}\right)$$

etc.,

after n years $$\left(1 + \frac{i}{100}\right)^n$$

If $$\left(1 + \frac{i}{100}\right)^n = 2$$

n is the number of years in which the original sum is doubled by compound interest at i per cent.

Taking the Naperian logarithims of either side of the equation:

$$n \log_e \left(1 + \frac{i}{100}\right) = \log_e 2 = \cdot 693.$$

The left-hand side expands in to the well-known series (which may be commanded by Taylor's Theorem):

$$n \left\{\left(\frac{i}{100}\right) - \frac{1}{2}\left(\frac{i}{100}\right)^2 + \frac{1}{3}\left(\frac{i}{100}\right)^3 - \text{etc.}\right\}$$

of which, for small values of i, the first is the only term of importance. We therefore have,

$$n \frac{i}{100} = \cdot 693 \text{ or } ni = 69.$$

But for the cases which most usually occur in practice, the easily divisible number 72 gives more satisfactory results. Of course, the number of years in which the first sum is doubled is practically the same as the number of years in which the last sum would be halved. We have only to conceive the years being taken in the reverse order to see this.

When the depreciation is written off the first cost, instead of the book value, and a sinking fund is in contemplation, the following formula has been devised by the writer for the purposes of approximate reckoning.

$$n\,(i + 3p) = 288 \text{ or } p = \frac{96}{n} - \frac{i}{3}$$

in which p is the amount per cent. of the annual premium to be written off. This formula is easily worked in the head, and gives fairly accurate results in such cases as ordinarily occur in practice. Thus:

No. of Years.	Rate of Interest.	Premium according to Formula.	Premium according to Fact.
12	2¼	7¼	7·35
48	4½	½	·574
30	3	2⅕	2·10
48	2¼	1¼	1·178
8	4½	10½	10·66

Where the premium written off and the interest are both at the same rate per cent., the result is commanded by the simple formula first quoted, $ni = 72$, since it gives the time in which the accumulations of interest become equal to the first amount.

TRAMWAY CONGRESS AT THE FRANCO-BRITISH EXHIBITION.

The "Official Circular" of the Tramways and Light Railways Association for May announces that a tramway congress will be held at the Franco-British Exhibition on July 9 and 10. The mornings only will be devoted to business, so that out-of-town members, a large number of whom are expected to attend, will be free to visit the Exhibition during the afternoons. Members will be received by the chairman of the Association and the members of the Reception Committee in the Congress Hall, at 10-30 a.m. on Thursday, July 9. At 11 a.m. Sir Clifton Robinson, one of the vice-presidents, will deliver a lecture on "The Tramways of the World." At 12 noon Mr. A. H. Gibbings will read a paper on "Tramway Rail Joints." At 11 a.m. on the Friday, Mr. A. L. C. Fell, vice-chairman of the Association, will take the chair. Professor C. A. Carus-Wilson will deliver a lecture on "Rail Corrugation," with illustrations of his experiments. A meeting will be held at the Association's offices on July 24, when there will be a discussion on this lecture. At 7-30 p.m. on the Friday the "banqueting hall" will be reserved for dinner for members and their friends (including ladies).

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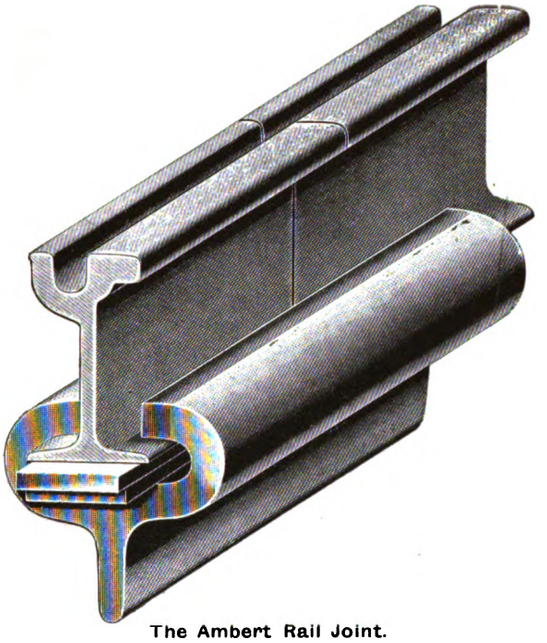
THE AMBERT RAIL JOINT.

Messrs. Brecknell, Munro and Rogers, of London and Bristol, are now putting on the market in this country the Ambert rail-joint, which is reported to be doing good service on the Continent. It is the invention of Mr. A. Ambert, of the Compagnie Nouvelle des Tramways de Lyons, at Neuville, Lyons, France. As will be seen from the accompanying illustration, the joint is formed by a coupling box, which embraces tbe flange of rail. One half of the box is occupied by the end of one rail, and the other by the end of the next rail, wedges being driven the full length of the box underneath the flange of rails.

The box has a solid bed for the rail ends to bear upon, and the metal at the sides of the box is turned over so as to form lips one at each side, which bear upon the upper surface of bottom flange.

The "stock" or bar from which the boxes are made is first rolled to the section shewn by full lines in the drawing, and is afterwards formed in a press and finished to the shape shewn by dotted lines. The material from which the box is made is a very high class spring steel, having a very high limit of elasticity, as compared with the strain which is put upon it by



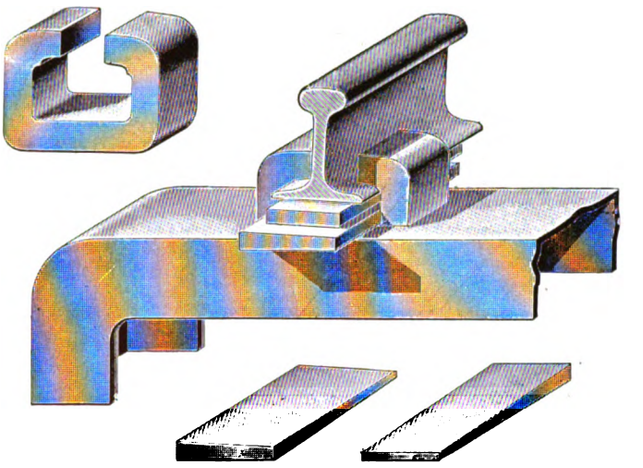
The Ambert Rail Joint.

the driving up of the wedges. A suitable amount of "draft" is allowed, so that when the wedges are driven or pressed up a force of 150 tons is gripping the two rail ends to the one solid box.

As the under sides of the rails are keyed up in the same horizontal plane, the upper or running face of the rails may present a shoulder or step owing to the difference in depths of the rails at the ends. This must be removed by planing or grinding.

There is thus a solid joint with a clean level running face, and rail ends free from any independent movement owing to the solid steel foundation to which they are pressed with a force of 150 tons. The rail, it is claimed, is at this point stronger and stiffer than at any other part. It should be stated that the bed of the box and the under side of the lips are faced, the wedges also being ground, to facilitate the assembling of parts and the ready removal of the joint in case of need.

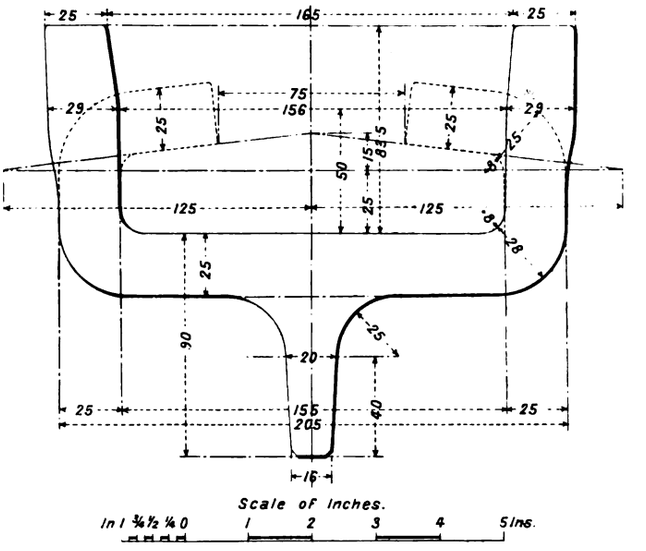
This joint is stated to be proof against vibration. During the period of five years in which it has been in use on a large number of tramways and railways on the Continent, no trouble from slack joints has been experienced. This brings us to a further important claim which is made for this joint, or rather the preceding remarks are the foundation for the statement made by the manufacturers that with the Ambert system that troublesome development at the joints of tramway rails known as "spooning" or the cupping of the "receiving" rail is eliminated, a statement based upon the fact, which has been amply demonstrated,



Joint Placed on Transverse Metal Sleeper.

that one rail cannot be depressed without the other: the whole moves as one piece.

With ordinary fish-plates and bolts it is difficult to maintain the face of concrete beneath the joint in good condition for any length of time, as the independent movement of rails or vibration pulverises the concrete, and the moisture which finds its way beneath the surface of the road reduces the powder to a fluid. It is this vibration or pounding that is eliminated, and the rail joint is put upon the same footing, and the conditions reduced to those obtaining throughout the whole length of the rail.



Showing Section of Joint Before and After being Clamped to the Rail.

Space has been secured in the French Section at the Franco-British Exhibition, where a number of examples of this work are on view.

A London Extension.—Part of the tramway of the London County Council from Hammersmith to Harlesden was opened for traffic on May 30. The route, which is equipped on the overhead wire system, is of special importance this year, as it affords communication with the Franco-British Exhibition.

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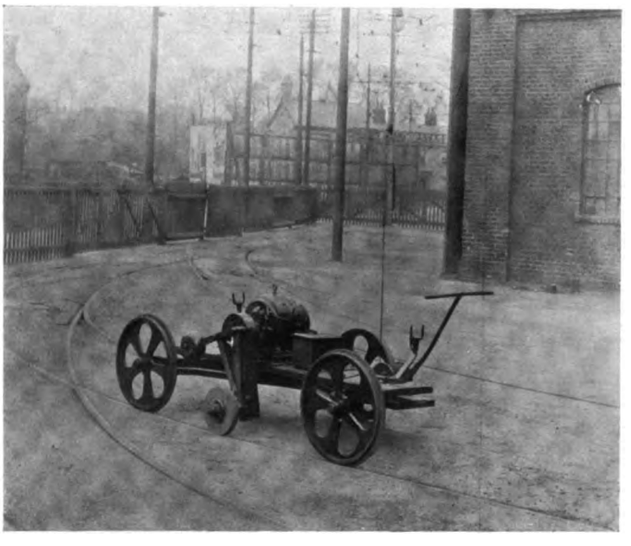
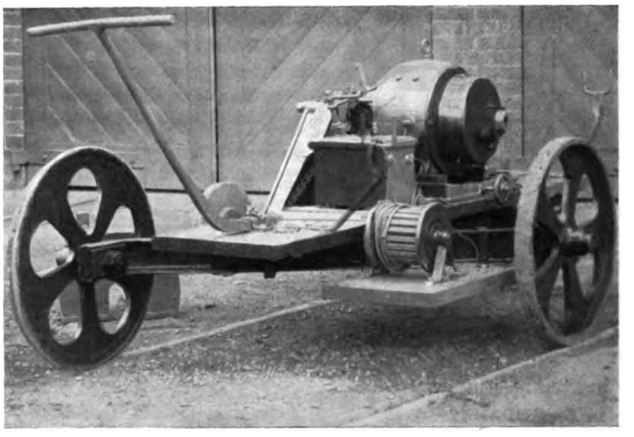
BANISTER'S PORTABLE TRACK GRINDER.

This track grinder, which is the invention of Mr. Alan N. Banister, general manager of Norwich Tramways, was designed for use on the Norwich Tramways, and has now been in successful service for some time. The machine itself consists of a very rigid triangular frame, made of 4 in. by 3 in. steel H section beam, carried on three wheels—two flanged wheels running on the rail to be ground, and one plain wheel on the other rail. The object of having no flange on the third wheel is two-fold—(1) to enable the machine, which weighs 9½ cwt., to be easily removed from the track, and (2) to allow of the machine being run round curves without undue friction. The steel frame carries a wood platform, upon which is mounted on a cast-iron base-plate a 4 H.P. 500-volt enclosed motor. This motor has one special armature shaft bearing, the outside of which forms a trunnion upon which a quadrant is mounted concentrically with the armature. Attached to this quadrant is a swinging arm carrying the grinding wheel. The arm is swung and held firmly in any position by means of a worm engaging into teeth cut on the periphery of the quadrant. The drive is effected by means of a "Hans Renold" silent driving chain working on chain pinions, on the armature shaft, and, emery wheel spindle. The feed is obtained by swinging the arm down, the handle on the worm being rotated for this purpose. The stone used is 14 in. diameter by 1½ in. face. The motor and attached grinding apparatus has a transverse motion on the carriage by means of a hand-wheel and screw, giving a motion 2½ in. inside and 2½ in. outside the gauge line. This enables the machine to grind rails on the sharpest curves, and also to grind out grooves in the bottom of points. The machine is clearly illustrated in the accompanying photographs.



Portable Track Grinder.

The grinder is easily operated by two men, the method of operation being to lower the emery wheel until it just touches the rail, and then to push the machine slowly backwards and forwards. The motor is fitted with a starter having an over-load, and a no-load, release, so that if too much feed is put on the only result is the opening of the switch. As an additional precaution a fuse is fitted. Current is carried to the machine by a bamboo trolley pole and flexible cable. The latter is wound on a drum (which can be seen in the photograph) fitted with contacts so that no more of the cable is unwound than is necessary. The return circuit is through the frame and wheels to the rails. Brackets are attached to the carriage for carrying the trolley pole when not in use. There is also a tool tray, and a waterproof canvas cover for the motor. The wheel and chain are covered with suitable shields. The whole machine is carefully worked out with a practical knowledge of conditions and requirements, and is well



Portable Track Grinder.

and substantially made to stand the hard usage that such machines are subjected to.

We understand that this machine, for which Mr. Banister has recently had several enquiries, will be placed on the market by The Consolidated Accessories Company.

THE G.B. SURFACE-CONTACT SYSTEM IN LONDON.

There has been some attempt recently to awaken anxiety without cause among the London public in regard to the surface-contact tramway now almost completed from Aldgate to Bow, the inference sought to be established being that, because there has been some trouble while the line is being put into working order, these troubles will continue after it is open for traffic. The feeling thus raised was voiced in the House of Commons, when Mr. B. S. Straus asked the President of the Board of Trade whether he was aware of the danger to horses and human beings, owing to the defective state of the tramway, and that accidents of a serious character had already occurred, and what steps the Board of Trade proposed to take. Mr. Churchill gave a reassuring reply. He stated that on the section which is not yet completed, two accidents, one to a man, and one to a horse, have been reported as having occurred through contact with a defective stud, while the track was being tested. Fortunately neither accident was serious. Before the lines are brought into use for traffic, an inspection will be held, and the Board's officers will require to be satisfied that all proper precautions have been taken.

Mr. Whitaker Thompson, chairman of the Highways Committee of the London County Council, was, at a meeting of the Council on May 26, bombarded with questions as to the installations of the G.B. surface-contact system which has been laid down from Aldgate to Bow, and on which experimental work is still proceeding. Mr. Thompson maintained his non-committal attitude, and declined to state definite opinions or facts. He refused to confirm a suggestion that there was an increase of 8 per cent. in the current consumed. Confidential reports had been received from the officers, but the ultimate result depended entirely on the regular working. At present the question of leakage was only a matter of surmise, and he was not prepared to say there would not be any tangible advantages from the adoption of the system. Until a regular service had been worked it was impossible to say whether the installation would be successful or not, and he hoped all comments would be reserved He thought that the car magnet was capable of picking up pieces of iron from the roadway, but the time had not yet arrived when the system would be declared so absolutely dangerous that it was necessary to put up notices to warn the public. They would see there was danger first before taking such a step. Members were not entitled to say that the G.B. system was a failure, and the Committee were not prepared to admit there had been any want of success. A report as to the further electrification of the northern lines would be brought up shortly. The G.B. system had not, so far, been offered to any other Borough Councils.

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HALIFAX TRAMWAYS AND SAFE WORKING.

Report by Major Cardew and Mr. H. G. Harris.

Major Cardew, R.E., and Mr. H. Graham Harris were appointed some time ago to investigate and report as to the working of Halifax Corporation tramways from the point of view of safety of the public. They have now presented the following important report to the Town Clerk:

We have the honour to report, as instructed by your letter of the 4th December last, we opened our inquiry on the working and management of the undertaking with regard to the safety of the travelling public, on the 6th February, 1908, at the Town Hall, Halifax. At this inquiry were present your sub-committee, the recently-appointed general manager, and the rolling stock engineer of your tramways, Messrs. Spencer, Senior and Junior (the late general manager and rolling stock engineer), the borough engineer and the town clerk. The views of the chairman and members of the sub-committee as to the scope and extent of our inquiry were ascertained, and evidence was given by the two present and the two former tramway officials and by the borough engineer as to the contributory causes of the recent fatal accident, the design and condition of rolling stock and equipment, condition and maintenance of permanent way, regulations for drivers and conductors of tramcars, and particulars of those routes on which, owing to long and steep gradients, curves, and liability to greasy deposit on the rails, special precautions are necessary.

After this sitting and discussion we proceeded to the car sheds, where we made a minute inspection of the various patterns of brake, sanding gear, and controllers in use at the present time, and also examined the equipment generally, and inspected the repair shop and the condition of all apparatus under repair. On the 7th February we inspected all the routes on which steep grades occur and carried out tests on the electric "run-back" brake and on the three patterns of "slipper" brake now in use. We will first describe briefly your tramway undertaking generally, and will express our opinion in detail on those points needing our comments.

General Description of Undertaking.

The tramway system of Halifax is an electrical overhead trolley system, working with the usual direct current at 500 volts. The total length of tramway route is 37 miles, and this represents 52½ miles of single track, a great proportion being on steep gradients, in some parts as steep as 1 in 9. On these gradients there are many curves, some of short radius, many in the centre or busy part of the town, with streets crossing the line at right angles, and much heavy traffic. The gauge of the track is 3 ft. 6 in., and the rails weighed originally 97 lb. per yard.

Generally speaking, it may be said that your tramway routes are bordering upon the limit of possible safe working by electric cars fitted with ordinary flanged wheels running on grooved rails; for not only are the gradients steep, but the hills are long and with many curves, and the exudations from the soil and deposits from the air and from other traffic frequently produce a greasy surface on the rails. Safety can only be secured, even with every possible mechanical safeguard and with the most careful regulations, by constant and unremitting attention to the maintenance of the efficiency of every working part of the cars and stock, including also that of the human element of "drivers" and "conductors."

The number of passengers carried in twelve months has averaged about 19 millions for the last two years, with a car mileage of about 1,650,000, which gives a number of passengers per car mile in excess of the average for similar undertakings. The average journeys per head of population served is given in your last report as 106, which is also, we believe, rather above the average. Notwithstanding these favourable features, however, your accounts show a loss on last year's working.

Such a system of tramways as yours must necessarily be somewhat more expensive in working cost and maintenance than if it were laid on the level, but in your case the expense appears excessive The car miles run per car per diem are decidedly low, especially if based on the total cars in stock, which reduces the figure to 46. We would also direct attention to the diagram published in the last report, showing consumption of energy per car mile; the persistent rise of the curve for 1906-7 as compared with 1905-6 being very striking. Also to the increase in the number of accidents given on page 13 of the report.

In these and other respects, referred to later, it appears your tramway undertaking in the past has not been maintained to the "level of perfection" which, having regard to the physical difficulties inherent to its construction and working, is essential to economy and to safety.

The best construction, equipment, supervision and manipulation are no whit too good for your requirements, and this standard of excellence, once reached, should be carefully maintained. In some respects your undertaking is in our opinion up to this standard; in others, with which we will deal in detail, it requires amendment.

To render this report (in which we shall have of necessity to carefully consider minute details of construction and working) as brief and intelligible as possible, we relegate to an appendix the discussion and consideration of the various points which require comment from us and simply include herein the recommendations which, in our judgment, should be adopted in order to secure the safety of the public and to render the working of your undertaking as satisfactory as, having regard to all the conditions and circumstances, it is possible to make it.

Taking the various items discussed and dealt with in full detail in the appendix hereto in the order in which they are set out in it, we suggest the following:

(1) *Permanent Way.*—The permanent way has been well laid originally, and is generally in good condition. Having regard to the great stress brought upon it, we recommend that in all cases when relaying is undertaken the joints should be properly anchored, and that granite setts should be exclusively used in the paving of all steep grades exceeding 1 in 20 and of curves of short radius. On several routes we noticed that the joints are out of truth, causing a knock as the wheels pass over them. These routes should be relaid as soon as can conveniently be arranged.

With regard to the cleansing of the surface of the rails, we do not think that the existing arrangement of "sprinklers" at the tops of hills satisfactorily answers the purpose, as it appeared that for considerable lengths the water merely flowed along the groove as a channel without washing the tread of the rails. In any case this method must be very wasteful of water. We recommend that for the present all steep grades should be swept by hand while the water is running, which will ensure a thorough cleansing of the tread. The profusion of water is prejudicial to the paving, especially in winter. We would point out that a tank car with sweeper would be of considerable service.

(2) *Cars.*—These are fairly suitable in size and design—a rather longer wheel-base with less overhang would conduce to safety on the steep grades. We have no doubt also that single-deck cars would give greater security and ease of control on these grades. The increased height of the centre of gravity with double-decked cars is distinctly prejudicial to the efficiency of the brakes, especially on steep inclines and on your narrow gauge. It might be considered, when new cars have to be obtained, whether single-deck cars with open sides should not be purchased for use as workmen's cars. In any case we would strongly urge that no cars with covered upper decks (of which pattern you now possess two) should be allowed to serve the routes with steep grades.

(3) *Trucks.*- These are mainly of two patterns, "Peckham" and "Brush." The former is, we consider, rather light in construction for the stresses to which these trucks are now subjected owing to the steep gradients, the high speed of running, the great weight of the motors, and the use of track brakes. These trucks, moreover, have seen much service. We recommend that they should all be thoroughly overhauled and strengthened where found necessary. On some of the "Brush" trucks we found that the axle-box springs had been removed. We agree with your present general manager that this removal was a mistake, and that it is likely to cause broken axles and undue vibration and hammering on the tracks.

(4) *Wheels.*—We recommend the use of steel-tyred wheels rather than chilled cast wheels as giving better effect in braking, and enabling "flats" to be more easily removed; these wheels also last longer.

(5) *Gearing.*—The gears shown to us appeared too narrow to be relied upon, considering the great power of the motors which may be suddenly applied in an emergency, or by a careless driver at other times. All gears should certainly be machine cut and with split wheels.

(6) *Motors.*—We prefer the 49B Westinghouse motor for steep grades on account of its giving better effect and taking less current, but we agree in the use of the higher speed motors if it is found that the difference in the speed between the 49B and the other motors, seriously affects the earning capacity of the cars.

(7) *Controllers.*—As regards these, we would emphasise the recommendations we felt necessary to give to you by letter immediately after our inspection, and would say that all controllers should be absolutely similar in their modes of working, although they may differ in their details; in other words, similar movements of the controller or other handle in similar directions should have similar effects. As a matter of fact, you have in use now controllers of five different patterns. The motions are similar in most of them as regards the application of power for propulsion, but as regards "braking"—and this after all, embraces the "emergency" question and the question of the safety of the public—these controllers differ very materially.

(8) *Brakes.*—The provision of ample brake power is of the utmost importance to your tramway system, having regard to the exceptionally steep gradients with which you have to deal, and further to the high speeds at which you run. We recommend that every car should be fitted with an efficient "emergency brake," and it is also necessary that there should be an adjustable brake for continuous use for controlling speed down steep inclines. It is obviously desirable that both these functions should be performed by one apparatus. In our judgment the latest form of "Spencer" track-brake fulfils, more satisfactorily than any other which you have in use, the necessary conditions as to this, but it requires to be handled promptly and effectively, and by a skilled

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driver. A satisfactory magnetic track-brake is equally suitable, and much more rapid and powerful in its application than any hand-brake can possibly be. A new form of "skid" brake has recently been devised, which, from published tests, appears to be very suitable for use as an emergency brake. It is still somewhat in the experimental stage, and we merely call your attention to it as a promising improvement.

(9) *Sanding Device.*—We recommend the replacing of the sanding device by such a device as will deliver the ordinary quantity of sand, necessary for ordinary working, under ordinary circumstances, and will also deliver, when worked by the driver from either end of the car, a much larger "emergency" quantity of sand in front of the wheels, no matter whether the car be running forward or backward.

(10) *Upkeep.*—We would most strongly impress upon the Committee the necessity for more careful attention to the upkeep and cleaning of the motors and all accessories than appears to have been exercised in the past. Numerous motors under repair were shown us in which there was evidence of damage caused by the motor having been allowed to run too long without attention. These remarks also apply to rheostats, cut-offs, wiring, and electrical and mechanical equipment generally.

(11) *Printed Regulations for use by Drivers and Conductors in Working.*—We have considered these, and the matter was dealt with at the meeting with the tramway officials, past and present, and as the result we make certain suggestions which will be found in the appendix. These deal only with certain points which are within our province, but we recommend that the whole of the regulations be re-arranged and re-considered, and that amended copies be printed and issued.

Should there be any further information which we can afford, we shall be only too pleased to answer any questions, or to deal with any further matter, or to attend a meeting in Halifax should the Committee or yourself desire it.

LONDON COUNTY COUNCIL TRAMWAY MATTERS.

SOME IMPORTANT CONTRACTS.

The London County Council resumed its meetings after the Easter recess on May 12, and during the month has dealt with several important contracts, including the supply of 175 double-deck bogie cars. When these cars have been delivered the Council will have 1,225 cars, including all types.

Loughborough Junction to Norwood.

The electrification on the overhead wire system of the tramway from Loughborough Junction to Norwood—the remainder of lines bought from the London Southern Tramways—was referred to in a report from the Highways Committee. The length of line is equal to five miles of single track, and the estimated cost is as follows:

	£
Track work, including special work and £9,100 for rails	44,500
Overhead equipment	6,490
Cables, cable-ducts, feeder pillars, etc.	12,660
Rolling-stock	13,650
Sub-station equipment	240
	£77,540

The rails, cables, and cars required were provided for in other estimates, and approval was now recommended of an estimate for the other items amounting to £45,330.

Anchoring Rails.

The Committee pointed out that in the conduit tramways first constructed, no measures were taken to anchor the track rails, and as the rails had begun to work loose it had been necessary to anchor them by fastening short lengths of inverted rails below and embedding them in a concrete foundation. The cost of this work was £8,763 in the year 1906-7, and £10,931 in 1907-8, while during 1908-9 it was estimated at £12,000. Under arrangements with the Finance Committee out of the cost for 1906-7 £5,700 was charged to capital account. It was now proposed that for the two succeeding years £6,400 and £7,000 respectively should be charged to capital, and the rest to revenue.

Consideration of the above reports was postponed, and a week later they were approved.

Cars for Transporting Stores.

The completion of the tramway-subway enables stores to be transported between any portions of the tramways and all the depots, and the Highways Committee proposed that six electric cars for the transport of stores should be obtained, at an estimated cost of £3,000. They would be built on lines similar to the electric watering cars, and the essential renewable parts would be interchangeable with those of the passenger cars.

Metropolitan Electric Tramway Bill.

The Parliamentary Committee, to whom a previous report by them on this subject had been referred back, now reported again, their amended proposals being that no opposition be offered to the Metropolitan Electric Tramways Bill for an extension of the Harrow Road and Paddington line to Edgware Road, subject to the insertion in the Bill of clauses providing that the powers with respect to the proposed extension should not be exercised unless the Council gave consent, and that in the event of the Council promoting a Bill hereafter for the construction of tramways along the same route the company should not oppose the proposal except on details.

Special Work.

Approval was asked for expenditure of £570 for special track work for a lay-by or siding at the Franco-British Exhibition, and that the special work be obtained from Hadfield's Steel Foundry Company as an extension of an existing contract. The siding would be double track, and would cost altogether about £1,950.

These reports were adopted.

Lea Bridge Tramways.

At a meeting of the Council, May 19, the Highways Committee reported on the proposed purchase of the part of the Lea Bridge, Leyton and Walthamstow Tramways within the county of London. The length was only about ⅜ of a mile, but it connected with the remainder of the same tramway system outside the county of London which was being worked by the Leyton Urban District Council. As a result of negotiations, it was recommended that the part of the line in London should be purchased for £8,200, that an estimate of £6,270 should be approved for the reconstruction and equipment of the tracks on the overhead trolley system, and that the lines should be leased to the District Council till August, 1911.

Dulwich to Forest Hill Tramways.

The Committee also recommended approval of expenditure of £32,630 for the construction on the conduit system of authorised tramways from Dulwich Library to Forest Hill, a distance of 1·18 miles. The estimate did not include the cost of rails, cables and rolling stock, which were otherwise provided for, and would bring the total up to £46,080. It was also proposed that a contract with Hadfield's Steel Foundry Company should be extended so as to include the special track work required, at a cost of about £1,786.

Supply of Rails.

In regard to the supply of rails, fastenings, etc., required for the electrification of the tramways proposed to be put in hand during the present financial year, the Committee submitted an estimate of £70,000 for rails, etc., for about 35½ miles of single track. In reference to the slot rails and conductor rails required for the Dulwich to Forest Hill tramways, it was proposed that an existing contract with the Frodingham Iron and Steel Foundry Company should be extended. The expenditure would be about £2,348.

Under the standing orders consideration of these reports was postponed, but at a meeting a week later they were approved.

Streatham Tramways.

The Improvements Committee reported details of a proposed agreement with Wandsworth Borough Council under which the latter would consent to a double line of tramway from the present Streatham terminus to Norbury, subject to the County Council executing street widenings, one-third of the cost of which would be paid by the Borough Council. The widenings would cost about £78,000, and would be spread over various periods up to 20 years.

Contracts for 175 Cars.

In connection with the supply of 175 additional bogie cars, the total estimated cost of which was £179,450, the Committee presented the following tenders for the car bodies:

	Price per car body. £ s. d.	Total. £ s. d.
Hurst, Nelson, and Co., Motherwell	414 0 0	72,450 0 0
United Electric Car Co., Preston	453 0 0	79,275 0 0
Metropolitan Amalgamated Railway Carriage and Wagon Co., Birmingham	460 0 0	80,500 0 0
Cravens, Ltd., Sheffield	472 10 0	82,687 10 0
Gloucester Railway Carriage and Wagon Co.	479 0 0	83,825 0 0
Brush Electric Eng. Co., Loughborough ...	483 0 0	84,525 0 0
G. C. Milnes, Voss, and Co., Birkenhead ..	550 0 0	96,250 0 0

The Committee proposed that the lowest tender should be accepted. With regard to the electrical equipment and assembly of cars, the following four tenders had been received:

	Price per car. £ s. d.	Total. £ s. d.
British Westinghouse Electric and Manufacturing Co., London	316 10 0	55,387 10 0
Dick, Kerr and Co., London	337 10 0	59,062 10 0
Siemens Bros. Dynamo Works, London ...	360 0 0	63,000 0 0
British Thomson-Houston Co., Rugby ...	370 0 0	64,750 0 0

The Committee proposed that the lowest tender should be accepted. In addition to these tenders an offer had been received from Dick, Kerr and Company for the supply of the complete cars at £939 10s each. This offer was higher than the total of the lowest separate tenders. It was further proposed that Hurst, Nelson, and Company be allowed to

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sub-let as under: (1) J. Crowley and Company, W. Towler and Company, and the Leys Malleable Castings Company, malleable iron castings; (2) Hoskins and Sewell, and Player and Mitchell, brass furniture, ratchet brake handles, head lights, window operating gear, and lighting fittings; and to such firms as might be approved by the chief officer, the timber, steel sections, paints, and varnishes required. It was also proposed that the British Westinghouse Company should sub-let to Watlington and Company, or Brecknell, Munro, and Rogers the supply of the trolleys.

These proposals were adopted.

Contract for Trucks.

At a meeting of the Council on May 26 the Highways Committee presented the following tenders received for the manufacture and supply of 175 sets of maximum traction swing bolster trucks for the car bodies already contracted for:

	£
Brush Electrical Engineering Co.	26,670 0 0
Brush Electrical Engineering Co. (alternative tender) ...	26,276 5 0
	(Not to specification.)
Mountain and Gibson (tender for foreign steel)	26,775 0 0
Mountain and Gibson (alternative to above)	26,250 0 0
	(Not to specification.)
Heenan and Froude	27,037 10 0
Mounta n and Gibson (tender for British steel)	27,650 0 0
Mountain and Gibson (alternative to above)	27,125 0 0
	(Not to specification.)
United Electric Car	27,650 0 0
Magnolia Anti-Friction Metal Co. of Great Britain	28,043 15 0
Metropolitan Amalgamated Railway Carriage & Wagon Co.	29,050 0 0
Thornewill and Warham	29,575 0 0
Hurst, Nelson, and Co.	29,793 15 0

In regard to the lowest tender in accordance with specification, the Brush Company took exception to the terms of the arbitration clause in the form of contract, and had not completely filled in the schedule of rates of pay. In these circumstances the Committee did not see their way to recommend acceptance of either of the Brush Company's tenders. The third and fourth tenders, submitted by Mountain and Gibson, provided for the use of foreign manufactured steel. The third lowest tender according to specification was submitted by Heenan and Froude, and this provided for steel of British manufacture. The tender was only £262 10s. higher than that submitted by Mountain and Gibson for steel of foreign manufacture. The advantages to be derived from the better supervision of the work which could be exercised if the steel was manufactured in Great Britain fully justified the slight additional expenditure. The Committee accordingly recommended that the tender of Heenan and Froude should be accepted, and that that firm should be allowed to sub-let portions of the work as under: (1) W. Shaw and Company and Edgar Allen and Company, steel castings; (2) Giles and Ward, Shotten Brothers, and Leys Malleable Foundry Company, malleable iron castings; (3) Cammell, Laird, and Company, and Steel, Peech, and Tozer, axles and tyres; (4) Hadfield's Steel Foundry Company, wheel centres; (5) Cammell, Laird, and Company, the Lyon Spring Company, and Smith Brothers and Hill, springs; (6) Lilleshall Steel Company, Sir A. Hickman, Limited, and Earl Dudley's, Limited, rolled steel sections; (7) Anti-Attrition Metal Company, axle-box bearings.

Track Rail Contract.

The following tenders had been received for the supply of 2,000 tons and 5,000 tons respectively of track rails and fastenings required for the construction of further lines:

	For about 2,000 tons. £ s. d.	For 5,000 tons. £ s. d.
Société Anonyme des Aciéries, Belgium...	12,429 14 2 ...	32,098 6 8
Edward Le Bas and Co., London (made by Société Anonyme d'Ongrée, Belgium)...	12,623 3 9 ...	32,523 10 0
P. and W. MacLellan, London (made by Angleur Co., Belgium)	13,115 11 3 ...	34,068 0 0
Bolling and Lowe, London (made by Phœnix Co., Ruhort, Germany)... ...	13,191 5 0 ...	33,803 10 0
	(not to specification)	
Bolckow, Vaughan, and Co., Middlesbro'	13,306 17 6 ...	34,640 0 0
Walter Scott, Leeds	13,761 5 0 ...	35,832 10 0

The chief engineer's estimates were £14,227 10s. and £36,567 10s. The Committee pointed out that in the past any cases in which materials required for tramway construction works had been obtained from abroad considerable delay had arisen. If one of the tenders for foreign rails was accepted, additional expenditure would have to be incurred for inspection. In these circumstances, and having regard to the terms of a resolution of November 19 last instructing committees to give the preference wherever possible in the purchase of manufactured articles to goods made within the United Kingdom, the Committee had decided to recommend acceptance of the tender of Bolckow, Vaughan, and Company for 5,000 tons, and that that firm should be allowed to sub-let to Guest, Keen, and Nettlefolds the supply of the bolts and nuts required.

Tramways Guide.

In reference to the publication of a first edition of 100,000 copies of a guide to the tramways, the Committee reported that they had further considered the question of the price at which it should be sold, and they now proposed that it should be sold at 1d. instead of 2d. per copy. The Establishment Committee presented twelve tenders which they had received for printing 100,000 copies of the guide, and they recommended that the lowest tender, namely that of the Argus Printing Company, should be accepted.

Sand-drying Apparatus.

The Highways Committee submitted six tenders received for the supply and erection of rotary sand-drying apparatus. The tenders varied from £620 to £1,450. It was recommended that the lowest tender, namely, that of Mountain and Gibson, should be accepted, and that that firm be allowed to sub-let parts of the work as under: (1) Lancashire Dynamo Company, Dick, Kerr and Company, and Mather and Platt, electric motors; Alldays and Onions, Standard Engineering Company, and Sturtevant Engineering Company, the rotary fan or blower.

Supply of Steel Tyres.

The following tenders had been received for the supply of steel tyres for electric cars:

	3,500 driving wheels. Price per tyre. s. d.	2,000 trailing wheels. Price per tyre. s. d.	Total cost. £ s. d.
Henry Bessemer and Co....	23 0	18 0	5,825 0 0
Cammell, Laird, and Co.	24 0	21 6	6,350 0 0
Brown Bayley's Steel Works	26 0	21 9	6,725 0 0
Steel Company of Scotland	28 0	25 0	7,400 0 0
Steel, Peech, and Tozer ...	29 1	26 7	7,747 18 4
Taylor Bros. and Co. ...	—	—	8,060 8 4
Hadfield's Steel Foundry Co.	34 9	31 9	9,256 5 0
Standard Steel Works ...	—	--	10,100 0 0
Vickers, Son, and Maxim	42 0	30 0	10,350 0 0
Wm. Beardmore and Co.	—	—	10,775 0 0
John Brown and Co. ..	25 0	21 3	—
	for 2,000 only		
John Baker and Co. (Rotherham)	24 6	—	—
	for 1,500 only		

The Committee had accepted the lowest tender, and the expenditure would be charged to revenue account.

Minor Contracts.

Confirmation was sought of a contract with Hurst, Nelson, and Company for moveable steps for 50 electric cars at £4 7s. 6d. a set.

The Committee had accepted a tender by the Anti-Attrition Metal Company for (1) 200 halves bronze motor axle bearings at 11½d. per lb.; (2) 300 bronze journal bearings D.W., at 8s. 3d. each; (3) 300 bronze journal bearings P.W., at 8s. each. There would be an allowance of 8d. per lb. on worn bearings. The expenditure would be charged to revenue account.

Street Widenings.

The Improvements Committee reported at length on further negotiations with the Borough Councils concerned as to the widening of Wandsworth Road, Lavender Hill, St. John's Hill, and East Hill in connection with the doubling and reconstruction of a tramway route. Battersea and Wandsworth Borough Councils had agreed to contribute one-third of the cost, while Lambeth Borough Council had refused to spend more than £3,500. The estimated cost, which was much higher than it had been in 1906, was £67,339. It was proposed that the execution of the work in Battersea and Wandsworth should be sanctioned at once, leaving the widenings in Lambeth to be dealt with subsequently, and that two-thirds of the cost payable by the County Council should be divided equally between the tramways account and the account of the improvement.

The recommendations were adopted. The rail contract was approved, after a heated party discussion. The Council adjourned till June 23.

A Tramwaymen's Tug-of-War.—Sir Clifton Robinson is the chairman of the surface transport section of the Franco-British Exhibition, and Lady Clifton Robinson has presented a challenge cup for a tug-of-war competition among teams of tramwaymen employed all over the country. The contest is to take place at the Franco-British Exhibition, London, on June 24.

Tramway Cars for Salerno.—The J. G. Brill Company has recently supplied cars to a number of Continental tramways. Among the latest shipments is one of 20 cars for Salerno, on the Gulf of Salerno, which adjoins the Bay of Naples. The tramway on which the cars will run connects Salerno with Pompeii, about 18 miles distant. Work was commenced on the line in July, 1907, and it is expected that everything will be in working order this summer. The line is equipped on the single-phase system, and it parallels the Italian Government railway. In addition to Salerno it serves seven towns with a total population of 250,000. Salerno itself has 45,000, or, including suburbs, 55,000 inhabitants. The cars constructed by the Brill Company for the line present no special features. They have vestibules and longitudinal seats. The length over all at the corner posts is 16 ft. 2 in., and over the vestibule 26 ft. 11 in. The width over posts at belt is 5 ft. 11 in. The cars are mounted on Brill 21 E trucks, with 6 ft. wheelbase, and are equipped with two 44 horse-power motors. Eight of the twenty cars are arranged for first and second-class passengers, and the other twelve for second-class only. The weight of the bodies of the former cars, excluding the trucks and equipment, is 6,876 lb.

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LIGHT RAILWAYS ACT, 1896.

ANNUAL REPORT OF THE COMMISSIONERS.

The report by the Light Railway Commissioners of their proceedings up to December 31, 1907, and the report of the proceedings of the Board of Trade, under the above-mentioned Act, up to the same date, were issued on May 22. On December 31, 1906, 16 orders were before the Board of Trade awaiting confirmation; 11 of these were confirmed in the year 1907, one has since been confirmed, and four are still held over. During 1907, 22 fresh orders were submitted to the Board of Trade by the Light Railway Commissioners for confirmation. Objections to confirmation were lodged with the Board of Trade in respect of certain of the orders, and in every such case a hearing was held at the Board of Trade. The Board considered each order, and made such amendments in the orders as were deemed necessary.

Fourteen of the orders submitted during the year 1907, in addition to the 11 above referred to, making 25 orders in all, were confirmed by the Board of Trade in the course of the year. In no case did the Board refuse to confirm an order.

The remaining orders, 8 in number, were still under consideration on December 31 last; but three of these have since been confirmed. A list of all the orders confirmed by the Board of Trade since the passing of the Act, with the date of confirmation and the mileage authorised, is annexed to the report.

The following tabular statement shows the total number of applications made to the Light Railway Commissioners in each year since the commencement of the Act, the number of applications made, and the number confirmed by the Board of Trade, with mileages and estimates:

Year.	Applications.			Orders Confirmed.		
	No.	Mileage.	Estimate.	No.	Mileage.	Estimate.
			£			£
1896.....	28	308	1,345,249	—	—	—
1897.....	58	566	3,342,602	4	38	208,403
1898.....	80	929	6,212,587	26	238	1,179,662
1899	83	853	6,958,508	35	303	1,936,985
1900	51	349	2,610,711	29	211	1,311,884
1901.....	70	652	6,890,338	49	337	2,629,725
1902.....	41	258	3,011,198	33	149	1,191,971
1903.....	39	192	1,646,084	37	179	2,019,798
1904.....	26	185	1,525,637	21	97	801,352
1905.....	35	151	1,570,988	21	39	321,349
1906.....	25	62	558,558	27	140	1,169,255
1907	20	89	548,238	25	40	499,862
Totals..	565	4,594	36,220,698	307	1,771	13,270,246

The Light Railway Commissioners sat at Blackburn on May 8, and approved the application for the Blackburn, Whalley, and Padiham Light Railways (Revival and Extension of Time) Order. On May 13, at Burnham-on-Crouch, the Commissioners heard the application for the Southend and Colchester Light Railways (Extension, New Works, Time, etc.) Order. At the close of the day the inquiry was adjourned till May 18, when the inquiry was concluded. On May 20 the Commissioners issued their decision rejecting the extension of time for the section between Burnham and the River Blackwater (including the piers and ferry on that river), and approving the application for extension of time so far as regards the sections (1) from Prittlewell to Burnham, with piers and ferry on the River Crouch, and (2) from Colchester to the north bank of the River Blackwater; provided that the works shall be substantially commenced within 18 months of the date of the Order. Mutual running powers were granted to the company, and to the Corporation of Southend, between Southend and Rochford. The proposed deviation from Creeksea Ferry into Burnham was also approved. On May 21 the Commissioners issued their draft of the Mid-Lincolnshire Light Railway Order, authorising the construction of a light railway from Sleaford to Kirkstead in the parts of Kesteven and the parts of Lindsey, in the County of Lincoln.

The Board of Trade have confirmed the following orders: Wolverhampton and Cannock Chase Railway (Light Railway) Amendment Order, 1908, amending the Wolverhampton and Cannock Chase Railway Act, 1901, and the Wolverhampton and Cannock Chase Railway (Light Railway) Order, 1907, in reference to the fund deposited in respect of the application for the Act of 1901 and otherwise (May 12). Clacton-on-Sea and St. Osyth Light Railway (Extension of Time) Order, 1908, reviving the powers granted and extending the periods limited by the Clacton-on-Sea and St. Osyth Light Railway Order, 1904, for the compulsory purchase of lands and for the completion of the railway and works by that order authorised and for other purposes (May 12). Campbeltown and Machrihanish Light Railway (Amendment) Order, 1908, amending the Campbeltown and Machrihanish Light Railway Order, 1905, by increasing borrowing powers for other purposes (May 15).

TRAMWAY AND ELECTRIC RAILWAY LEGISLATION.

SECOND READINGS. - In the House of Lords.—May 18: West London, Barnes and Richmond Tramways. May 20: Leeds Corporation.

In the House of Commons.—May 5: Edinburgh Corporation (Tramways, etc.) Order Confirmation.

THIRD READINGS.—In the House of Lords.—May 19: Rochdale Corporation. May 26: Bristol Tramways; Edinburgh Corporation Tramways. Order Confirmation.

In the House of Commons.—May 11: Edinburgh Corporation (Tramways, etc.) Order Confirmation. May 21: North East London Railway. May 25: Wolverhampton Corporation. May 26: Doncaster Corporation.

AYR CORPORATION.—A Commission sitting in Glasgow, under the Scotch Private Legislation Procedure Act, passed this Provisional Order application on May 1. There was no opposition. The Order authorises the Corporation to construct two additional tramway lines. A confirmation Bill was introduced in the House of Commons on May 27.

BRISTOL TRAMWAYS.—Intimation was made to the House of Lords on May 12 that the opposition to this bill had been withdrawn.

BURNLEY CORPORATION.—The tramway portion of this bill, which proposes the construction of some short extension lines, was passed by a House of Commons Committee on May 12. There was no opposition either to the proposal to run motor 'buses in connection with the tramways, and it was sanctioned. The 'buses are to serve districts not yet sufficiently developed to warrant the construction of tramways. It is proposed to start with a service of three 'buses, and it is estimated that working expenses, depreciation, and debt charges will not exceed 1/- per mile run. A superior noiseless vehicle costing about £1,000 is proposed.

GREAT NORTHERN, PICCADILLY, AND BROMPTON RAILWAY.—On May 12 it was intimated to the House of Lords that the opposition to this bill had been withdrawn.

HIGHGATE HILL TRAMWAYS.—The House of Lords was informed on May 5 that the promotors of this Bill did not intend to proceed further with it. This is consequent on the agreement between the tramway company and the London County Council for the purchase of the tramways by the latter body.

KEIGHLEY CORPORATION.—The bill, among other things, seeks to empower the Corporation to provide and work motor omnibuses. When it came before a Committee of the House of Lords on May 12, intimation was made that there was now no opposition except to a part of the measure relating to waterworks and land.

LANARKSHIRE TRAMWAYS.—This application for an Order under the Scotch Private Legislation Procedure Act came before a Parliamentary Commission sitting in Glasgow on May 1. The objects of the proposal are to extend the time by three years for the completion of certain authorised tramways, and to enable the company to run omnibuses and to raise additional share capital to the extent of £153,000, with £51,000 of additional borrowing powers. It was mentioned that the length of lines already completed was 15½ miles, and 12 miles more had yet to be constructed. There was no opposition, and the Order was passed.

LEITH BURGH.—This bill was before a House of Lords Committee for several days. The part providing for the construction of tramways was reached on May 21, and as there was no opposition to the tramway scheme, it was passed without remark. It will be remembered that the differences between Leith and Edinburgh Corporations on the subject were recently adjusted after prolonged negotiation.

LONDON MOTOR ROADWAYS APPROACH—Intimation was made to the House of Lords on May 5 that the promotors of this Bill did not intend to proceed further with it.

LONDON UNITED TRAMWAYS.—This bill came before a Committee of the House of Commons on May 19. Its main object is to authorise construction of tramways across Kew Bridge to connect the company's lines north and south of the Thames, and the opposition came from the Middlesex and Surrey County Councils, who asked for payment of £2,000 a year from the company as wayleave. Among the witnesses for the promotors was Sir Clifton Robinson, who stated that in the whole of the company's district £1,000,000 of capital had been exacted from them by local authorities, so that instead of giving a return to their shareholders of 5 per cent., as they should have done if the wayleaves and exactions had been eliminated, they had paid only 1 per cent. On May 20 the Committee passed the bill, and ordered a clause to be inserted providing for wayleaves of £500 each per year being paid to the County Councils of Surrey and Middlesex. The Committee at first suggested that the amount should be settled by arbitration, but various difficulties and the possibility of heavy expenses were pointed out, and the Committee then decided on the figure of

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£1,000 to be divided equally between the two County Councils. Thus the contention of the Councils for a special charge in consideration of the great cost of the bridge and of their having built it of exceptional width, so as to suit tramways, was, to a certain extent, given effect to.

METROPOLITAN DISTRICT RAILWAY.—A House of Lords Committee met on May 13 to consider this bill, when it was announced that the opposition to it had been withdrawn. It was referred to the Committee on unopposed bills.

NOTTINGHAMSHIRE AND DERBYSHIRE TRAMWAYS.—The Standing Orders Committee of the House of Commons decided on May 5 that the standing orders should be dispensed with, and that the promoters of this bill should be allowed to introduce it. The measure was only recently brought forward as the result of an agreement with Nottingham Town Council as to construction of authorised lines and as to running powers.

BELFAST TRAMWAY MATTERS.

Mr. Andrew Nance, general manager of the Belfast tramways, has issued from the tramways office, Sandy Row, Belfast, a book of rules and regulations for his motormen and conductors. The book measures 3 in. by 5¼ in., and contains 250 pages. The contents include general rules, rules for motormen, time guide, slipper brake instructions, table of precedence at junctions, rules for conductors, points of collection, list of destinations, tramway by-laws of the city of Belfast, and Board of Trade by-laws for the Belfast city tramways. The book is printed in clear type, on good paper, and a careful study of it should add much to the efficiency of any employee.

A section of the public in Belfast were dissatisfied with some of the rules when they were issued, and this feeling found vent by Mr. Devlin being put up to ask a question in the House of Commons on May 11. He asked the Chief Secretary for Ireland, whether his attention had been called to the regulations for motor-men and conductors recently issued by the Belfast Corporation, and in particular to a rule prohibiting such persons from taking any active part in any municipal or general election, whether on or off duty, under penalty of dismissal; and whether, in view of the interference of this rule with the men's rights as citizens, and of the fact that it was not in existence even in Government departments, the Local Government Board would refuse their sanction to its being enforced.

Mr. Birrell replied: I am informed that the regulations in question were issued by the general manager of the Belfast Corporation tramways, for the purpose of maintaining discipline among the employees. I have been referred to a copy of the particular rule alluded to in the question, which states that motor-men and conductors are expected to refrain from taking active part in any municipal or general election whether on or off duty, but the penalty of dismissal applies only to a breach of the rule committed while on duty. The right of voting is not interfered with. The necessity for the rule is alleged to have been demonstrated by a recent instance in which a conductor canvassed the passengers in his car. The Local Government Board have no powers in respect of these regulations, which are not subject to their confirmation.

Since the early spring of this year when the Belfast Corporation Bill for the purchase of Cavehill and Whitewell tramways was rejected by the House of Commons, various negotiations have been carried on between the Corporation and the tramway company for the purpose of coming to some arrangement whereby through runnning could be secured between the Corporation's tramways and the Cavehill line. The matter has been the subject of much vigorous discussion locally. At a meeting of the Corporation Tramways Committee, on May 4, it waa agreed, by six votes against three, to recommend the Corporation to enter into a working agreement with the company for the establishment of a through service between Castle Junction and Glengormley on the basis of a threepenny through fare; all fares collected on the city tramway to go to the Corporation, and all on the company's lines to the company on the terms of the Oldham-Manchester agreement; any agreement to this effect to provide that the Corporation be at liberty to purchase the company's undertaking at any time within five years at a sum not exceeding £60,000. This resolution carries out the proposal contained in an elaborate report to the committee by Mr. Nance, the general manager, in which he discussed the various alternatives and showed that the course now taken would be the best both for the Corporation and the public. The company have since agreed to carry out their part of the arrangement.

Mr. Nance presented to Belfast Tramways Committee on May 11, his report for the year ended March 31 last. From this it appeared that the receipts showed an increase of £12,674, and the working expenses and fixed charges an increase of £20,384. The largest items of increase were wages of drivers and conductors, £4,108; permanent way repairs, £2,082; power, £5,207; fixed charges, £3,819. The net result was that the Committee had £4,300 in hand after paying working expenses and fixed charges. This would fall far short of the £13,000 which had been settled upon as the annual amount to be set aside for depreciation. The second year's working of the extended stages fixed by the Council condemned them as unremunerative. The cost of working was only 4·95d. per car mile, which was the lowest in the United Kingdom. The fact was that the stages were too long, and Mr. Nance reminds the Committee that these stages were fixed against his consent. His warning as to raising wages also had not been attended to. Mr. Nance recommends that nothing be paid to depreciation fund this year, that the net balance of £4,300 be used to reduce a small balance still existing against the net revenue account, and that at the earliest possible moment the present stages be withdrawn and replaced by the stages proposed by him in 1905.

At a meeting of the Tramways Committee on May 25, Mr. Nance reported that according to instructions he had reduced the service on some of the routes where the traffic did not justify the service given. The reduction in the car mileage would be about 580,000 car miles per annum, and the actual annual cash saving in expenses would amount to between £6,000 and £7,000. He was of opinion that the change would not bring about any reduction in the volume of receipts. The report was approved.

Mr. Nance also presented a special report on fares and stages. In this he said he was of opinion that the result of last year's working clearly established the fact that the present stages were too long, and that there was no reasonable prospect of their producing a sufficient revenue to meet expenses and fixed charges. He advised that they should be withdrawn as soon as possible. He had reason to believe that all those people in Belfast whose opinion was worth considering would gratefully recognise that the Committee had made a generous effort to give them the cheapest tramway fares in the United Kingdom, that they had done their utmost to make those fares a success, and that the fares were only modified because the Committee were bound to maintain the undertaking financially in the condition of rock-like security prescribed by what was known as the Aberdeen clause. He strongly advised that the stages which he submitted to the Committee in June, 1905, should be put into operation without delay. They were compiled with great care, after much thought, and with exhaustive consideration of each district. They involved less change from the present conditions than any other course which could be suggested. They would be cheerfully accepted by all reasonable people, that was to say, by practically everyone, and they would increase the revenue per car mile materially. The present condition of affairs called for bold treatment on business lines. Other possible changes of fares were highly speculative, and some had been proved in practice to be detrimental. A moderate and well-considered reduction of the stages, such as he proposed, would meet all the requirements of the situation.

The adoption of the report was moved, as was an amendment providing for penny stages a mile and a half long, and a halfpenny stage for every three-quarters of a mile beyond the penny distance, with a 3d. fare for through journeys from terminus to terminus. The amendment was defeated by the casting vote of the Lord Mayor, and another amendment to postpone consideration was also rejected. The motion to approve of Mr. Nance's proposals was then agreed to. The scheme adopted provides for 1d. and 2d. stages somewhat shorter than those hitherto granted.

At a special meeting of the Town Council on May 29, the reports were considered and a motion was put forward condemning them as containing inaccuracies and reflections on the Committee, and declaring the manager and accountant deserving of censure for want of knowledge of the financial position. This, however, was withdrawn, and it was agreed to refer the reports back to the Committee with instructions to investigate the accounts and to report on the working of the system.

MUNICIPAL TRAMWAYS ASSOCIATION.

The half-yearly meeting of the managers' section of the Municipal Tramways Association took place in Wolverhampton on May 28 and 29. On the former day the Mayor (Councillor F. Evans), Alderman Craddock and Alderman Berrington, and members of the Tramways Committee, received the members at the Town Hall. The Mayor welcomed the visitors, and Alderman Craddock (in the unavoidable absence of Alderman Mander, chairman of the Tramways Committee) also spoke. He stated that there were not 20 miles of track in the British Islands that had given less trouble than those on the Lorain system in Wolverhampton. Mr. J. Aldworth, Nottingham, responded. In the evening the managers were entertained at dinner by Alderman Mander. During the business sittings of the managers, which were conducted in private, the following papers were read and discussed.—"Description of the Wolverhampton Tramways System," introduced by Mr. W. A. Luntley, general manager of Wolverhampton Corporation Tramways; "Car Building in Departmental Workshops," by Mr. J. Ferguson, of Glasgow Corporation Tramways; "Tramway Rating Valuations and Income-Tax Assessments," by Mr. F. A. Mitcheson; and "Tabulated Information respecting the distance at which a tramway passenger paying a penny fare ceases to be remunerative," by Mr. C. W. Mallins, of Liverpool Corporation Tramways. During the visit the Lorain surface-contact system in Wolverhampton was inspected, and a visit was made to the car depot. The whole arrangements, which were very successful, were under the care of Mr. A. R. Fearnley, the hon. secretary.

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FINANCIAL COMMENT.

By the reduction of the bank rate on May 28 to 2½ per cent. the inauguration of a period of cheap money received the official imprimatur. The phraseology is that of Lombard Street, and by no means signifies that the many manufacturers and merchants, wrestling with insufficient working capital and ebbing trade, are about to experience the relief from anxiety which easily-raised funds would afford; "cheap money" in this connection simply means that the banks will lend money at low rates to those who stand in no particular need of it. Money is only cheap to unimpeachable borrowers, and those who are anything less than top notch will be surprised how much they have to pay for it, if they have not already informed themselves. Indeed, the proposals of many borrowers in a position which would have commanded a ready advance, say this time last year, would not, now, be entertained at all.

According to experience in times past, the lower charges for loanable money should be accompanied by a general rise in the price of gilt-edged securities, and, to a certain extent, this has already occurred, largely by reason of the activity of speculative dealers, who think to anticipate the requirements of the public. The advance may be maintained, and will probably proceed further during the summer, but its continuance cannot be predicted with any confidence. Precedent is a good watchman, but not a good guide; the times never repeat themselves exactly. In the present instance the enormous monetary requirements of borrowers whose obligations are called gilt-edged suggest that the advance will be most pronounced in fixed dividend securities of a less exalted character, but yielding a larger return, and particularly in those of foreign origin, since faith in the stability of British institutions is undoubtedly touched by the careless attitude which many members of the present Government have adopted towards them. Among foreign securities which will doubtless benefit as regards market quotations from a period of cheap money are several tramway undertakings, which now yield well over 4½ per cent., as will be seen from an examination of our Tramway and Omnibus Share List.

THE METROPOLITAN AMALGAMATED RAILWAY CARRIAGE AND WAGON COMPANY, LIMITED.

This company is a model of successful amalgamation. Its origin is to be sought in the Ashbury Railway Carriage and Iron Company, which was founded by James Ashbury at Openshaw in the neighbourhood of Manchester, though its title is derived from the Metropolitan Railway Carriage and Wagon Company of Saltley not far from Birmingham. The combination now includes Brown, Marshalls and Company, the Lancaster Railway Carriage and Wagon Company, the Oldbury Railway Carriage and Wagon Company, the Patent Shaft and Axletree Company, the Old Park Bridge and Girder Works, the Monway Steel Works, the Brunswick Wheel and Steel Works, and more recently the business of Docker Brothers, the well-known varnish manufacturers. Assuming the combination had been in existence on the same footing as at present, the record of profits would have been:

	£		£
1902-3	175,378	1905-6	223,848
1903-4	192,481	1906-7	206,841
1904-5	194,117	1907-8	246,496

The profit for the last year would permit of a dividend being paid at the rate of 17 per cent. on the whole share capital, which amounts to £1,432,940 (there are no debentures), and the table above indicates clearly that profits in the past have been earned at a rate not very much less. But the shares do not all rank equally, 164,288 being "A" preference shares of £1 and 235,000 "B" preference shares of like nominal amount, bearing preferential rights to dividends of 5 per cent. and 6 per cent. respectively, which are cumulative, but without right to further participation. Deducting the £25,180 required for the dividend upon these shares from the profit for last year we have £221,296 earned and distributable among 949,808 ordinary shares of £1 each, which is rather more than 23 per cent. The directors advise that £100,000 of this amount be appropriated to augment the reserve fund, and propose dividends which mean 15 per cent. for the ordinary shareholder, a third thereof, or five shillings per share, being described as a bonus, to mark, no doubt, the fact that it is not a distribution that can wisely be expected to continue from year to year.

Last year, as everyone was aware, presented conditions specially favourable for builders of rolling stock, as there was a shortage more or less acute in almost every quarter of the globe. It would be interesting to know some details of the expenses incurred in earning this highly satisfactory return, but of these nothing can be ascertained, as no revenue account accompanies the balance sheet. The business is, however, chiefly confined to the manufacture of rolling stock for British and foreign companies, and the amalgamated company is known to be but little engaged in the wagon finance business on which a number of its competitors rely for a large portion of their income. The accounts show that sundry debtors owe £233,736, and part of this may be due from purchasers who are paying for wagons by instalments. Even this amount is less by £2,545 than for the previous year, and there is nothing to show that the company have lent money on existing rolling stock, as often occurs in connection with undertakings of this character. The item "investments, £530,207" might, however, be presented at greater length with advantage; it is £174,508 greater on this occasion. There are two other changes in the balance sheet which deserve attention. Stock-in-trade and work in progress, which are unfortunately bunched together, are £42,305 less, at £189,253, which is good so far as it affects the stock-in-trade if it means that stocks were reduced when prices were high, but bad so far as it affects work in progress, which no doubt it must, to a large extent Cash at bankers and in hand is £204,084 greater, at £406,658, a very handsome balance which the company must be congratulated on realising at this juncture, though its very magnitude is an indication that it is finding difficulty in fully employing its capital.

THOMAS TILLING.

This is a very old concern, although the date of its conversion into a public company is but recent. Its position and immediate prospects are of considerable interest because the respective provinces of horse-drawn and motor vehicles in the London streets must be decided in the conduct of the business. The company owns motor omnibuses and horse omnibuses, besides a large number of cabs for public hire, and other vehicles for private use. In its former condition as a private concern it has undergone the shock which the passenger street-carrying trade experienced when the suburban London railways were constructed, and again the check to omnibus traffic which took place when horse tramways were initiated, and the management, which has been continuous throughout, contains many members who still retain a lively recollection of the difficulties which were then met with, and of the measures which were successful in surmounting them. The present difficulties chiefly consist in the low fares charged by the County Council tramways, and severe competition of recently promoted or reconstructed motor omnibus companies, both of which, in the opinion of many, are charged on a scale which must involve loss in the long run. This particular company is fortunate in having a private trade in horse vehicles and more recently in motor vehicles, which has grown up from small beginnings in its early days. It is, therefore, in a better position to sustain the stress of competition than some of its rivals. The first motor omnibuses introduced proved too noisy, and have had to undergo a radical reconstruction to render them suitable for London traffic. At the annual general meeting held on April 21 it was stated that the whole cost of the changes made in them had been met out of revenue.

The accounts are presented with items so skilfully grouped that it is difficult to extract precise figures in support of this statement. The amount in the revenue account in which is included maintenance of motor vehicles is £11,078 more than for last year, and while, in the balance sheet, horses taken at the directors' valuation is nearly £7,000 less, the item which comprises all vehicles together is over £16,000 more. The purchases of new motors have probably, therefore, been as considerable as the reconstruction of old, and the company is evidently embarked on a policy of substituting motor for horse traction at a pace as fast as its finances will allow. This has entailed an absorption of liquid assets which encroaches on the working capital of the business and, of course, weakens its financial position. Thus trade creditors are greater by £3,249, while creditors for loans and interest are greater by £6,938; at the same time investments in Colonial Government stocks are less by £12,050, debtors by £5,073, and cash by £8,721. Hence the directors have been unable to advise a dividend on the ordinary shares, and undoubtedly they adopt the more sensible course in not further depleting the liquid assets of the undertaking.

No depreciation has been written off any vehicles for this year. The figures given by the chairman in his speech suggest that as far as the horse vehicles are concerned they are already written down to prices less than they would fetch, while so much has been spent this year in reconstructing the motor vehicles that a depreciation charge for them is not thought needful. The company has a long history of sound management behind it, and may hope to earn satisfactory profits again when experience has fixed the commercial limitations for the various forms of public traction in London.

THE CARTHAGENA AND HERRERIAS STEAM TRAMWAY COMPANY, LIMITED.

The unusual conditions of traffic on this tramway were referred to in our issue of January 10, in which it was pointed out that although the company had been earning at a rate sufficient to pay 12 per cent. on its share capital for the past twelve months, the state of the reserve fund precluded the likelihood of any such rate of dividend being paid. The shares were at that time quoted at 7, a very moderate figure considering the amount of traffic handled, but since then the market price has fallen to 4, on account of the paralyzing effect which the depression in the iron trade has produced on the minerals carried by this tramway. The accounts of the company presented to the meeting held on May 18 last confirm the views expressed in our former issue. The net profit, after payment of debenture interest and sinking fund charges, amounted to £15,541, or rather more than 10 per cent. of the share capital, the expenses for maintenance and renewals having been incurred on a rather more liberal scale. Of this sum £7,000, or nearly half, was appropriated to the augmentation of the reserve for improvements and renewals, thereby doubling the amount of this provision

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TRAMWAY AND OMNIBUS SHARE LIST.

Specially Compiled for "The Tramway and Railway World."

Amount Ranking for Dividend.	Shares.	Name.	Div'd. Prev. Half-year.	Div'd. Last Half-year.	Quotations, May 28	Movement During May. Rise.	Movement During May. Fall.	Latest Business Done. Price.	Latest Business Done. Date.	Yield on Buying Price. £ s. d.	Dividend Due.*	Quotations, 1907. Highest	Quotations, 1907. Lowest.
260,007	5	Anglo-Argentine Tramways 6% Cum. 1st Pref.	10%	3/-	6½ - 6¾	+ ⅛	...	6½	May 27	4 12 6	*Apr., Oct.*	6¾	5 15/16
320,000	5	Do. do. 10% Non-Cum. 2nd Pref	5½%	5/-	7 11/16 - 8 3/16	+ 1/16	...	8⅛	May 28	6 2 3	*June, Dec.*	8	7⅞
75,606	1	Bath Electric Tramways Pref. Ord.	...	1/-	⅜ - ⅝	...	...	13/-	Mar. 5	...	*Apr., Oct.*	1	¼
75,000	1	Do. do. 5% Cum. Pref. ..	5%	5%	11/16 - 13/16	...	...	16/3	Mar. 7	6 3 6	*Jan & July*	1	13/16
15,000	10	Blackpool and Fleetwood Tramways ...	4/-	9/-	12¼ - 12½	+ ½	...	12⅛	May 14	5 4 0	22 Aug.	..	...
100,000	16/-	Blackpool, St. Anne's, and Lytham Ord. ..	...	...	— ⅛	...	...	...	...	...	...	...	...
50,000	18/-	Do. do. 5% Cum. Pref.	...	...	⅛ - ¼	...	...	...	...	...	...	...	...
60,000	10	Bombay Elec. Supply & Trys. Co. 6% Cum. Pref.	4/8·377	5/2·176	10 - 10½	...	...	10½	May 14	5 14 3	Feb., Aug.	8¾	7⅞
75,000	5	Brisbane Elec. Tramways Investment Co. Ord.	2/-	4/-	3¾ - 4	+ ⅛	...	70/10½	May 27	5 0 0	*May.*	3 7/16	1 11/16
75,000	5	Do. do. do. 5% Cum. Pref.	5%	2/6	4¾ - 5	+ ⅛	...	98/9	May 27	5 0 0	*May, Nov.*	5 1/16	4 9/16
50,000	10	Bristol Tramways and Carriage Co.	8½	9½	10 - 10½	...	...	10	May 7	8 11 6	*Feb., Aug.*	15¼	14
50,000	10	Do. do. do. 4% Cum. Pref.	4	4	8 - 8½	...	...	8⅛	May 21	4 14 3	...	...	...
400,000£	Stk.	British Columbia Electric Railway Def. Ord. ..	8%	for '07	132 - 135	+ 4	...	133	May 19	5 18 6	May, Nov.	135	122½
300,000£	Stk.	Do. do. Pref. Ord.	6%	for '07	115 - 119	+ 4	...	117	May 27	5 3 6	May, Nov.	116½	105
300,000£	Stk.	Do. do. 5% Cum. Perp. Pref.	5%	for '07	108 - 112	+ 1	...	110½	May 13	4 11 0	May, Nov.	110¾	101
133,301	10	British Electric Traction Ord.	6/-	for '06	1¾ - 1½	...	— ⅛	25/7½	May 26	...	Apr., *Oct.*	4½	1½
161,437	10	Do. do. 6% Cum. Pref. ...	6/-	...	3⅞ - 4⅛	...	— ⅛	77/6	May 28	...	Feb., *Aug.*	8½	4½
100,000	5	Buenos Ayres and Belgrano Electric Trys. Ord.	3/-	for '07	4⅜ - 4¾	...	...	93/9	Mar. 10	3 1 6	*Apr., Oct.*	4 11/16	2 15/16
40,000	5	Do. do. "A" 6% Cum. Pref.	6%	3/-	4⅜ - 5⅛	...	...	98/9	Apr. 29	5 17 3	*Apr., Oct.*	5½	4¾
27,500	5	Do do. "B" do.	6%	3/-	4⅜ - 5⅛	...	...	5	Feb. 10	5 17 3	*Apr., Oct.*	5⅜	4¾
113,436	5	Buenos Ayres Grand National Tramways Ord....	...	...	2⅛ - 2⅜	...	..	43/9	May 16	...	*Jan.*	3⅜	2
90,000	5	Do. do. do. 5% Cum. Pref.	3/-	2/6	3¾ - 4¼	...	...	76/3	May 16	5 17 9	...	4¾	3¾
137,610	5	Calcutta Tramways Ord.	3/6	2/6	5⅜ - 6⅜	...	— ½	6	May 28	4 14 3	*Apr., Oct.*	8 15/16	6⅜
45,304	5	Do. 5% Cum. Pref.	5%	2/6	5 - 5⅜	...	...	5 3/16	May 26	4 13 0	Jan., July	5⅜	5 1/16
491,222	1	Cape Electric Tramways	6d.	for '05	3/16 - 7/16	...	...	5/3	Apr. 7	...	Feb., *Nov.*	11/16	⅛
15,000	10	Carthagena and Herrerias Steam Tramways ...	7%	6/-	3½ - 4½	...	...	84/4½	May 25	17 15 9	*June*	11½	6 11/16
40,000	5	City of Birmingham Tramways 5% Cum. Pref.	10%	2/6	4¼ - 4¾	...	...	5 3/16	Mar. 4	5 5 3	*Apr., Oct.*	5½	4 5/16
248,000	5	City of Buenos Ayres Tramways (1904) ...	5%	1/3	5 7/16 - 5 11/16	+ 1/16	...	5⅜	May 28	4 8 0	*Apr., Oct.*	5½	4 15/16
60,000	1	City of Carlisle Electric Tramways	1 1/16%	for '06	2/3 - 2/9	...	...	...	...	...	*Feb.*	...	...
5,000	10	Clontarf and Hill of Howth Tramways ..	...	1 5/16%	5½ - 6½	+ ⅜	...	6⅛	May 26	1 10 9	...	...	...
11,500	10	Cork Electric Tramways and Lighting Co. ...	10/-	ann.	9½ - 9¾	...	...	...	...	3 3 3	*Mar.*	9¾	8¾
12,327	10	Do. do. do. 5% Cum Pref.	5/-	5/-	9¾ - 10½	...	...	10	Feb. 26	4 17 9	Jan. 1. Dec. 30	...	...
3,000	10	Dublin and Lucan Elec. Railway 5% Cum. Pref.	5/-	5/-	5¾ - 6½	...	...	6	Apr. 24	8 0 0	Sep. 15. Aug. 29	...	...
1,900	10	Do. do. do. Ord. ...	...	...	— 3½	...	...	...	...	...	...	...	...
60,000	10	Dublin United Tramways Co. (1896), Ltd., Ord.	6/-	7/-	12½ - 13½	...	...	12½	May 27	4 16 6	Feb., Aug.	15	12⅞
60,000	10	Do. do. do. 6% Cum. Pref.	6/-	6/-	12½ - 13½	...	...	12⅜	May 27	4 9 0	*Feb., July*	14 13/16	12⅛
40,000	5	Hastings and District Elec. Trys. 6% Cum. Pref.	...	4/-	3¾ - 4¼	...	— ⅛	82/6	May 16	7 1 3	*Mar., Sept.*	4⅛	4⅛
20,000	10	Imperial Tramways Ord.	8	10	10 - 11	...	— ½	10¾	May 28	8 3 9	...	...	...
20,000	10	Do. 6% Cum. Pref.	6	6	9¾ - 10½	...	...	9⅞	May 28	5 17 3	...	...	...
30,000	5	Isle of Thanet Elec. Try. & Ltg. Co. 5% Cum. Pref.	1/3	for '06	⅞ - 1⅜	...	...	20/-	Feb. 17	...	*Mar., Sept.*	2½	1
250,000	1	Kalgoorlie Electric Tramways	...	...	1/32 - 3/32	...	...	1/3	May 2	...	*May*	3/32	1/16
28,723	10	Lanarkshire Tramways	5/6	6/-	9¾ - 10	...	— ⅛	9⅞	Apr. 23	5 15 0	Feb. Aug	10½	9¾
594,188	1	Lisbon Electric Tramways Ord.	5	1/-	1 - 1½	...	...	20/-	Feb. 15	4 4 3	*July.*	1 7/16	⅞
425,553	1	Do. do. 6% Cum. Pref ...	6	7½d.	1 - 1¼	...	...	...	...	5 2 3	*July.*	1 5/16	⅛
773,592£	Stk.	London General Omnibus Ord.	5%	for '07	34 - 39	+ 6½	...	33	May 28	...	Mar., Sept.	79	36
25,000	10	Do. do. 5% Cum. Pref. ...	5%	5/-	4 - 5	...	...	82/6	May 14	...	Jan., July.	9½	4½
74,000	6	London Road Car Ord	2/6	for '06	1¼ - 1¾	+ ½	...	32/-	May 28	...	Feb., Aug.	4	2⅛
8,200	10	Do. 5% Cum. Pref.	5/7½	5/-	4 - 6	...	-- 1	85/-	May 28	7 2 9	Feb., Aug	...	...
31,000	4	London Street Tramways	2/-	2/6	5/16 - 7/16	...	...	...	...	...	*Mar.*	11/16	⅜
125,000	10	London United Trys. (1901). Ltd., 5% Cum. Pref.	2/-	5/-	7 - 8	+ ½	...	7¼	May 27	6 8 3	*Jan., July.*	9½	7⅞
314,016	1	Metropolitan Electric Tramways Def.	...	...	1/32 - 3/32	+ 1/32	...	1/-	May 25	Nil	...	3/16	1/16
500,000	1	Do. do. do. 5% Cum. Pref.	6d.	6d.	11/16 - 13/16	...	...	14/3	May 25	6 3 3	*Feb., Aug.*	1	¾
$6,000,000	$100	Mexico Tramways Common Stock	2%	$1	93½ - 95½	+ 10½	...	93¾	May 26	4 6 0	Feb. 1, May 1 Aug. 1, Nov. 1	...	...
50,000	5	New General Traction 6% Cum. Pref.	...	...	½ - 1	...	...	...	...	...	Jan., *July.*	1¾	¼
110,923	4½	North Metropolitan Tramways	1/-	...	⅛ - ⅜	...	...	5/-	Apr. 6	...	...	...	...
5,000	10	Oldham, Ashton, and Hyde Elec. Tramways Ord.	7/-	5/-	8⅜ - 8⅞	...	...	9⅜	Mar. 23	6 19 3	...	...	...
5,000	10	Do. do. do. 5% Cum. Pref.	5%	5%	8 - 8½	...	...	...	...	6 1 3	...	..	...
100,000	1	Perth (W.A.) Electric Tramways Ord.	5%	1/-	17/32 - 21/32	...	— 1/32	11/-	May 28	7 12 6	*Mar.*	11/16	3/16
245,000	1	Potteries Electric Traction Ord.	...	9½d.	¼ - ½	...	...	...	...	9 3 0	*Mar.*	¾	¼
245,000	1	Do. do. 5% Cum. Pref. ...	5	6d.	9/16 - 11/16	...	...	11/-	Apr. 10	7 5 6	*Feb., Aug.*	13/16	½
24,912	10	Provincial Tramways Ord.	3/-	5/-	4¾ - 5¼	...	...	4⅞	Jan. 25	7 12 6	*Dec.*	5⅜	4
10,000	10	Do. do. 6% Cum. Pref.	6/-	6/-	9½ - 10½	...	...	10 7/16	Feb. 11	5 14 3	June, *Dec.*	11½	10½
30,000	5	Rangoon Elec. Trys. & Supply Co. 6% Cum. Pref.	...	3/-	5¼ - 5¾	...	...	5 7/16	Apr. 6	5 4 6	June, Dec.	5¾	5
250,000	$100	Rio de Janerio Tramways Light and Power Co.	...	...	42 - 43	+ 8	...	41½	May 28	...	...	...	...
85,000	$100	Sao Paulo Tramway, Light, and Power Co. ...	$2¼	$2¼	129 - 134	...	...	131¼	May 22	6 6 0	*Apr., Oct.*	145	101
6,343	10	Snowdon Mountain Tramroad Ord.	...	...	5 - 8	...	...	...	...	...	...	...	...
169,570	1	S. Metrop'n Elec. Trys. & Ltg. Co. 6% Cum. Pref.	6½d.	7½d.	¼ - 1	...	...	19/-	Mar. 3	6 0 0	Feb., Aug.	1 1/32	⅛
3,900	5	Southport Tramways	...	...	3 - 3⅛	...	...	...	...	...	...	...	...
40,000	5	Yorkshire (West Riding) Elec. Trys. Ord. ...	...	...	1 - 1½	...	...	...	...	...	*Mar.*	1½	¾
46,261	5	Do. do. do. 6% Cum. Pref.	...	...	3⅛ - 3⅞	...	...	72/6	Jan. 22	...	*Mar.*	3¾	3⅛

ELECTRIC RAILWAY SHARES.

1,853,610£	Stk.	Central London Ord. Stock	3	3	80 - 83	+ 6	...	82½	May 28	3 12 3	*Feb., Aug.*	82¾	54½
1,480,000£	Stk.	City and South London Cons. Ord. Stock ...	2½	1¾	39 - 41	...	...	40¼	May 28	5 3 9	*Feb., Aug.*	50½	39
78,000	10	Great Northern and City Pref. Ord. 4% ...	11½d.	...	¾ - 1¼	...	...	20/-	May 26	...	*Feb., Aug.*	3¾	1½
159,000	10	G.N., Piccadilly, and Brompton Ord.	4/-	4/-	6 - 7	...	...	6½	Apr. 23	5 14 6	*Feb., Aug.*	8	4
50,000	10	Liverpool Overhead Ord.	...	6d.	1⅜ - 1½	...	...	28/9	May 5	1 13 6	*Feb., Aug.*	2	1¼
1,412,262£	Stk.	Mersey Cons. Ord. Stock	...	...	1 - 3	...	— 1	30/-	May 4	Nil	*Feb., Aug.*	7	2
5,732,062£	Stk.	Metropolitan Cons.	½	½	43½ - 44½	+ 1½	...	44½	May 28	1 3 6	*Feb., Aug.*	60¼	31½
3,235,000£	Stk.	Metropolitan District Ord.	...	...	13½ - 14½	+ 2	...	13⅝	May 28	Nil	*Feb., Aug.*	19¼	7½
2,499,200£	...	Underground Electric Railways Co. of London, Ltd., 5% Profit-sharing Secured Notes.	5%	ann.	39 - 43	+ 3	...	41	May 22	12 10 0	*June*, Dec.	89	34
1,100,000	...	Do. do. Deposit Receipts ...	...	...	39 - 43	+ 3	...	41	May 25	...	...	...	...

* Date of final payment is given in italics.

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for capital deterioration, £4,500 was devoted to the payment of a final dividend of 3s. per share, making 5 per cent. for the year, and the remainder sufficed to increase the amount carried forward by rather more than £1,000. The company have now over a quarter-of-a-million tons of ore stacked on their property ready for transportation as soon as conditions of the iron trade permit a return to normal market conditions, in expectation of which most of the mines in the locality are continuing production. The heavy reduction in receipts which have continued since the beginning of the year is, therefore, in all likelihood but temporary, and the managers of this small tramway will have considerable difficulty in coping with arrears of traffic if this large accumulation of ore is required to be moved in a hurry.

Debentures and loans together come to £701,496, which is nearly as much as the issued share capital, £772,822, a somewhat heavy load for so precarious a business as the production of a minor metal. Stocks of metals, raw materials, and stores amount to £103,244. Debtors exceed creditors by £7,332, and cash is £13,097. From this it will be seen that even if the terms upon which the loans of £160,000 have been obtained can be extended indefinitely, the company would be inconvenienced by demands for funds from its subsidiaries in excess of amounts contemplated, such as might arise out of inadequate estimates of the cost of completion of works.

THE BRITISH ALUMINIUM COMPANY, LIMITED.

Aluminium as a potential or actual substitute for copper, is a metal the production of which must always engage the attention of those whose business is connected with electrical enterprise. Of the companies concerned in the production of the metal the British Aluminium Company occupies the most prominent position in the public age. The capital of the company, including debentures, amounts to £1,314,318, and there are loans to the further amount of £160,000. The net profit resulting from last year's operations was £120,482 before providing for depreciation or debenture interest, but after payment of the interest on loans, which enabled a dividend of 7 per cent. to be paid on the ordinary shares and sundry writings-off to be effected on a fairly liberal scale. The major part of the profit was derived from hardly more than a moiety of the capital embarked in the company's enterprise, since £733,309 appear as investments in the shares of subsidiary and other companies, the receipts from which are set down in the revenue account as £15,616, after deducting interest on loans, the amount of which latter is not given. 1907 was a hard year for borrowers, and the company may have been obliged to pay heavily for the money lent to it, but allowing fully for this, the company can have received only a small return on its investments compared to the profit from its own trading. This is, of course, due to the fact that the works of the companies in which investments have been made are still in process of development, and the British Aluminium has indeed still to furnish considerable sums for their completion. It is to be hoped that the remainder of the £390,700 applied for in the £10 conversion shares of 1908, of which £2 only had been paid up at the date of the balance sheet, will suffice for the purpose, since the financial position therein displayed is not adapted to withstand any severe strain on the resources of the company.

RIO DE JANEIRO TRAMWAY, LIGHT AND POWER COMPANY, LIMITED.

This is a company of Canadian origin which has engaged capital in London, Paris, Brussels and New York, and has the benefit of expert advice and assistance derived from the best quarter in each of these centres, all of which is devoted to the electrical development of the metropolis of Brazil. It owns concessions in Rio de Janeiro and its neighbourhood which are beyond doubt of immense value, and quite able to bear the somewhat heavy load of debenture debt which the difficulty of raising funds for the completion of works in progress now imposes on the undertaking. The developments contemplated were referred to in our issue of May 2, and the opportunity afforded by the stocks of this company deserve the attention of all investors interested in electrical work and in a position to appreciate the rapid progress which is taking place in Brazil.

Aston Tramways.—A public meeting was held at Aston on May 28, at which a resolution was unanimously adopted, protesting against the action of the Town Council in holding a private meeting to consider the tramway question, and condemning the decision arrived at to permit the British Electric Traction Company to receive £10,000 out of the profits made, and further calling for the appointment of a tramway committee, to whom the whole question should be referred. It was also decided to appeal to the Mayor to withhold the sealing of the proposed agreement, and that a deputation wait upon him asking him to convene a public meeting of protest. It was also agreed that a committee be formed for the purpose of petitioning the Local Government Board on the subject.

Great Northern, Great Central, and Great Eastern Agreement.—We are authorised to state that the directors of the Great Northern, Great Central, and Great Eastern Railway Companies have decided to seek Parliamentary powers with the view of entering into a working agreement based upon the arrangements recently approved by the shareholders of the Great Central and Great Northern Companies. The three companies have already made arrangements for co-operation in connection with the movement of their traffic which will tend towards economy in working.

LIGHT RAILWAY APPLICATIONS.

We give below a list of the applications for Light Railway Orders which were deposited with the Light Railway Commissioners in May. It will be seen that the total number of applications is seven, four of which apply for powers to construct 21 miles of railway at an estimated cost of £138,251. The three other applications are for amendment Orders, one of which asks for power to alter fares, one for amendment of borrowing powers, and one for extension of time for the compulsory purchase of land and for construction.

Of the new lines proposed three are to be worked by steam on the standard gauge of 4 ft. 8½ in.; and the remaining one is of the nature of an electric tramway of the 3 ft. 6 in. gauge.

LIST OF APPLICATIONS MADE TO THE LIGHT RAILWAY COMMISSIONERS IN MAY, 1908, FOR LIGHT RAILWAY ORDERS.

	Title.	County.	Promoters.	Engineers.	Mileage.	Motive Power.	Gauge. ft.	Gauge. in.	Agents.
1.	Bath Electric Tramways (Amdt.)	—	Bath Electric Tramways Limited	—	Alteration of fares		—		Paines, Blyth and Huxtable.
2.	Bradford Corporation (Nidd Valley Light Railway Orders) (Amdt.)	—	Corporation of Bradford ..	—	Amendment of Borrowing Powers.		—		Dyson & Co.
3.	Central Essex (Extension of Time).	—	Light Railways Syndicate Limited	—	Extension of Time.				E. W. I. Peterson
4.	Hatfield Moor. .	York (W.R.)	Lancashire & Yorkshire & North Eastern Railway Companies	D. C. Rattray W. J. Cudworth	8¾	Steam	4	8½	A. de C. Parmiter R. F. Dunnell
5.	Merrivale.	Devon. ..	Duke & Company, Limited ..	Prigg & Lindon ..	1¾	Steam	4	8½	Adams & Croft (Plymouth)
6.	Minster on Sea. .	Kent. ..	Geo. Ramuz, R. J. Thompson and J. Wright	F. W. S. Stanton ..	1¾	Electric	3	6	Carpenter & Wilson
7.	Upper Wharfedale. ..	York (W.R.)	P. C. Hemingway, W. H. Ashwell and D. Ferguson	E. O. Ferguson ..	8¾	Steam	4	8½	Wyatt & Co.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track). Mls.	Line open (single track). Chs.	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Sinking Fund and Loans Repaid.	Depreciation, Renewal, and Reserve Funds.	Income. Traffic.	Income. Other.	Income. Total.
Aberdeen ...	May 31, 1907	Dec., 1899	E.	27	60	350,000	317,140	32,860	345,025	12,433	299,970	17,169	40,155	65,853	834	66,687
Ayr ...	May 15, 1907	Sept., 1901	,,	9	52	105,000	70,000	35,000	79,934	8,283	62,752	4,820	14,954	14,672	541	15,213
Birmingham ...	Mar. 31, 1907	Jan., 1904	,,	...		1,079,687	743,037	336,650	850,916	...	732,016	11,021	25,932	132,662	3,762	136,424
Blackburn ...	Mar. 25, 1907	Mar., 1899	,,	23	64	400,337	328,087	72,250	330,563	13,469	236,042	81,647	...	52,811	2,141	54,952
Blackpool ...	Mar. 31, 1907	June, 1899	,,	17 * 3	30 69	424,490	281,390	143,100	281,390	16,195	281,390	54,624	13,236	50,554	952	51,506
Bolton ...	Mar. 31, 1907	Dec., 1899	,,	42	42	632,760	528,027	104,733	471,760	11,093	377,482	71,801	48,622	110,935	359	111,294
Bradford ...	Mar. 31, 1907	July, 1898	,,	87 * 9	67 6	1,192,626	902,878	289,748	903,368	9,321	756,992	200,046	38,024	227,495	4,612	232,107
Brighton ...	Mar. 31, 1907	Nov., 1901	,,	17	15	279,070	274,070	5,000	274,905	15,994	257,186	20,885	3,165	48,898	1,755	50,653
Burnley ...	Mar. 31, 1907	Dec., 1901	,,	14 * 5	20 32	278,892	252,896	25,996	185,325	13,005	175,331	23,012	20,793	62,076	728	62,804
Burton-on-Trent	Mar. 31, 1907	Aug., 1903	,,	9	70	100,073	88,336	11,737	92,971	9,415	83,746	...	...	15,102	430	15,532
Bury ...	Mar. 31, 1907	June, 1903	,,	17 * 9	50 21	407,800	225,525	182,275	242,466	13,757	223,500	8,246	5,904	50,518	131	50,649
Chester ...	Mar. 25, 1907	April, 1903	,,	6	35	92,991	73,991	19,000	77,662	12,064	70,221	5,141	332	10,274	329	10,603
Chesterfield ...	Mar. 31, 1907	Dec., 1904	,,	5	68	95,000	68,528	26,472	68,529	11,714	65,000	2,557	...	10,989	503	11,492
Colchester ...	Mar. 31, 1907	July, 1904	,,	7	75	70,748	68,755	1,993	68,847	8,673	65,858	4,214	...	10,787	580	11,367
Croydon ...	Mar. 31, 1907	June, 1906	,,	19	44	336,611	254,010	82,601	270,043	13,813	224,234	35,276	...	61,091	975	62,066
Darlington ...	Mar. 31, 1907	June, 1904	,,	8	71	107,500	75,165	32,335	76,293	8,584	69,425	5,540	...	10,820	323	11,143
Darwen ...	Mar. 31, 1907	Oct., 1900	,,	7	13	93,400	85,400	8,000	85,436	11,928	73,879	13,658	1,150	13,327	681	14,008
Derby ...	Mar. 31, 1907	July, 1904	,,	E. 15 H.	1 ...	...	...	...	175,247	...	159,722	15,525	...	E 37,558 H 4,184	871 147	38,429 4,331
Doncaster ...	Mar. 31, 1907	June, 1902	,,	10	42	92,500	84,200	8,300	84,735	8,051	79,300	5,727	...	12,030	337	12,367
Douglas (I.O.M.)	Mar. 31, 1907	..	H. C.	3 2	40 60	54,020	54,020	...	55,514	8,882	49,166	4,889	3,000	20,220	1,314	21,534
Dundee ...	May 15, 1907	July, 1900	E.	24	41	...	...	...	312,886	12,746	258,824	47,613	26,780	56,921	751	57,672
East Ham ...	Mar. 31, 1907	June, 1901	,,	12	61	160,442	160,133	309	164,064	12,855	146,323	20,775	3,442	46,435	653	47,088
Gloucester ...	Mar. 31, 1907	April, 1904	,,	12 * 2	41 39	151,000	126,000	25,000	127,326	10,186	123,333	3,993	...	14,192	841	15,033
Halifax ...	Mar. 31, 1907	June, 1898	,,	52	26	663,751	393,764	269,987	393,280	7,516	333,287	48,149	8,544	75,986	1,341	77,327
Ilford ...	Mar. 31, 1907	Mar., 1903	,,	11	28	142,603	142,396	207	142,396	12,546	129,549	13,054	6,532	24,478	912	25,390
Ipswich ...	Mar. 31, 1907	Nov., 1903	,,	14	70	116,471	110,000	6,471	114,334	7,687	106,098	4,674	...	21,262	780	22,042
Keighley ...	June 30, 1907	Oct., 1904	,,	6	9	50,934	46,004	4,930	46,004	7,526	39,891	6,827	1,641	8,019	222	8,241
Kilmarnock ...	May 15, 1907	Dec., 1904	,,	5	42	65,000	54,615	10,385	54,078	9,788	54,615	151	...	8,246	357	8,603
Kirkcaldy ...	May 15, 1907	Feb., 1903	,,	7	62	200,000	88,693	111,307	89,404	11,499	83,750	4,943	1,267	13,230	473	13,703
Lancaster ...	Mar. 25, 1907	Jan., 1903	,,	4	65	60,000	51,550	8,450	41,339	8,590	46,250	5,651	...	5,360	119	5,479
Leith ...	May 15, 1907	Aug., 1905	,,	11	76	225,000	171,345	53,655	179,796	15,046	179,062	6,873	...	26,380	643	27,033
Lincoln ...	Mar. 31, 1907	Nov., 1905	2	2	77	98,519	43,072	55,447	39,231	15,243	48,061	2,819	...	5,741	104	5,845
Liverpool ...	Dec. 31, 1906	Nov., 1898	E.	104	0	2,442,600	2,044,775	397,825	1,901,997	18,288	1,604,435	503,941	238,354	563,777	7,439	571,216
Lowestoft ...	Sep. 30, 1907	July, 1903	,,	5	79	129,230	79,231	49,999	79,231	13,233	75,135	5,076	...	10,937	349	11,286
Maidstone ...	Mar. 31, 1907	July, 1904	,,	2	23	25,000	25,000	...	26,255	11,477	25,005	1,250	2,000	5,650	241	5,891
Manchester ...	Mar. 31, 1907	June, 1901	,,	111 *43 †14	6 57 54	1,875,015	1,558,669	316,346	1,725,845	15,538	1,436,184	144,197	320,028	712,976	6,697	719,673
Nelson ...	Mar. 31, 1907	Feb., 1903	,,	3	69	38,000	35,662	2,338	35,662	9,233	33,291	2,371	...	7,264	55	7,319
Newport (Mon.) ...	Mar. 31, 1907	April, 1903	,,	14	40	264,500	189,819	74,681	199,424	13,753	180,461	18,003	1,046	32,547	652	33,199
Nottingham ...	Mar. 31, 1907	Jan., 1901	,,	35	58	730,300	581,734	148,566	581,734	16,284	473,128	116,340	53,668	137,998	1,995	139,993
Oldham ...	Mar. 25, 1907	May, 1902	,,	27 * 8	20 31	507,769	439,547	68,222	440,422	16,162	380,354	94,643	6,119	92,763	1,315	94,078
Perth ...	May 15, 1907	Nov., 1905	,,	8	40	70,000	73,400	...	74,879	8,809	70,450	3,710	...	7,985	411	8,396
Plymouth ...	Mar. 31, 1907	Sept., 1899	,,	15	0	182,856	174,906	7,950	215,986	14,399	132,872	45,355	23,126	31,256	10	31,266
Rochdale ...	Mar. 31, 1907	May, 1902	,,	24 * 5	45 26	354,491	345,000	9,491	343,246	13,974	345,000	16,231	...	53,830	308	54,138
Rotherham ...	Mar. 31, 1907	Jan., 1903	,,	10	0	228,550	112,500	116,050	123,914	12,391	104,040	8,517	9,181	26,917	819	27,736
Salford ...	Mar. 31, 1907	Oct., 1901	,,	36 *38	40 20	1,192,246	669,583	522,663	574,853	15,749	626,609	125,701	46,146	232,551	...	232,551
Southampton ...	Mar. 31, 1907	Jan., 1900	,,	16	22	202,539	172,397	30,142	200,183	12,300	164,242	35,659	690	49,636	1,368	51,004
Southport ...	Mar. 31, 1907	July, 1900	,,	10 * 8	61 78	292,000	196,500	95,500	195,412	9,930	157,230	39,270	6,773	18,176	307	18,483
South Shields ...	Mar. 31, 1907	Mar., 1906	,,	10	21	252,171	134,061	118,110	155,422	15,145	133,360	7,653	2,531	23,992	46	24,038
Stalyb'ge, Hyde, Mossley, & D'k'f'd	Mar. 31, 1907	May, 1904	,,	27	57	325,270	259,470	65,800	258,177	9,318	244,028	15,442	...	38,766	39	38,805
Sunderland ...	Mar. 31, 1907	Aug., 1900	,,	19	40	304,086	294,461	9,625	289,691	14,825	233,485	52,094	...	72,054	342	72,396
Wallasey ...	Mar. 31, 1907	Mar., 1902	,,	12	55	140,436	138,150	2,286	138,917	10,950	127,918	10,723	18,592	42,254	630	42,884
Walsall ...	Dec. 31, 1906	Dec., 1902	,,	15 * 2	2 5	188,144	151,000	37,144	142,947	8,366	145,900	6,162	...	26,400	546	26,946
Warrington ...	Mar. 31, 1907	April, 1902	,,	9	52	128,050	100,446	27,604	101,615	10,530	89,721	10,831	1,530	19,204	336	19,540
West Ham ...	Mar. 31, 1907	Feb., 1904	,,	26	35	509,119	353,753	155,366	547,989	20,728	531,494	11,822	19,548	116,793	2,982	119,775
Wigan ...	Mar. 31, 1907	April, 1901	,,	24	70	461,570	459,670	1,900	515,212	20,712	465,985	55,168	...	61,101	1,368	62,469
Wolverhampton	Mar. 31, 1907	April, 1902	2	20 * 4	0 40	279,228	245,861	33,367	254,606	12,730	227,359	17,260 Motor O	18,051 mnibuses	43,183 2,375	640 45	43,823 2,420
Yarmouth (Gt.) ...	Mar. 31, 1907	June, 1902	E.	12	4	144,500	110,000	34,500	110,363	9,159	101,791	5,424	1,197	21,390	512	21,902

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast ...	Mar. 31, 1907	Nov., 1905	E.	73	18	1,225,448	1,060,000	165,448	1,115,784	15,232	1,060,000	22,256	13,000	177,832	3,307	181,139
Bexley ...	Mar. 31, 1907	Oct., 1903	,,	6	73	98,259	96,984	1,275	94,858	13,723	90,854	6,130	...	11,419	1,569	12,988
Birkenhead	Mar. 31, 1907	Feb., 1901	,,	23	79	366,266	357,854	8,412	357,991	14,914	306,891	50,964	11,025	54,252	1,156	55,408
Bournemouth ...	Mar. 31, 1907	July, 1902	,,	34 *10	35 0	381,554	381,554	...	401,668	11,664	368,221	35,518	24,999	83,663	360	84,023
Cardiff ...	Mar. 31, 1907	May, 1902	,,	36	50	802,039	732,383	69,656	767,109	20,948	689,467	73,808	9,277	106,551	12,564	119,115
Glasgow ...	May 31, 1907	Oct., 1898	,,	165 * 10	47 55	3,100,000	2,227,353	872,647	3,104,061	18,746	1,679,974	547,379	1,122,104	887,381	8,461	895,842
Huddersfield ...	Mar. 31, 1907	Feb., 1901	,,	33 * 3	0 20	646,284	398,957	247,327	412,902	12,512	325,819	82,507	44,360	78,115	3,081	81,196
Hull ...	Mar. 31, 1907	July, 1899	,,	27	15	488,673	436,543	52,130	436,543	16,057	436,543	67,357	74,775	121,186	...	121,186
Leeds ...	Mar. 31, 1907	Aug., 1897	,,	96	50	1,340,374	1,340,374	...	1,303,815	13,494	1,167,263	213,248	33,270	323,913	3,891	327,794
Leicester ...	Dec. 31, 1906	May, 1904	,,	37	0	734,838	678,805	56,033	677,829	18,320	651,645	46,672	41,448	114,752	1,776	116,528
London ...	Mar. 31, 1907	May, 1903	1	H 100 E 116	6 55	*	*	*	6,736,737	31,077	6,133,564	603,173	141,855	567,694 810,320	15,296 14,676	582,990 824,996
N'castle-on-Tyne	Mar. 31, 1907	Dec., 1901	E.	53 *6	0 10	1,413,989	1,164,028	249,961	1,150,701	21,711	1,029,992	152,476	43,515	205,262	3,392	208,654
Northampton ...	Mar. 31, 1907	July, 1904	,, H.	9 ...	6 ...	128,300 ...	127,255 ...	1,045 ...	127,374 ...	14,036 ...	115,546 ...	11,709 ...	2,113 ...	21,542 770	542 88	22,084 858
Portsmouth ...	Mar. 31, 1907	Sep., 1901	E.	28	40	672,272	661,714	10,558	670,157	23,514	618,341	100,715	48,695	98,911	3,103	102,014
Preston ...	Mar. 31, 1907	June, 1904	,,	17	16	224,102	187,269	36,832	187,269	10,888	167,775	14,487	9,907	37,796	150	37,946
Reading ...	Mar. 31, 1907	July, 1903	,,	13	15	231,658	231,658	...	220,783	16,742	204,993	22,548	7,466	32,661	972	33,633
Sheffield ...	Mar. 25, 1907	Sep., 1899	,,	66	28	1,163,646	1,133,770	29,876	1,172,279	17,683	970,620	136,278	74,245	276,907	2,679	279,586

E—Electric trolley system. H—Horse lines. C—Cable lines. * Indicates lines leased. † Lines on which running powers are exercised.
1 Horse, conduit, and electric. 2 Surface contact.
* Conferred by Annual Money Act, which limits amount for each financial year. Powers not exercised are lapsed.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name	Operating Expenses.					Net Income.	Additions to Net Income.	Deductions from Net Income.						Net Surplus + or Deficit −
	Traffic.	General.	Repairs & Maintenance.	Power.	Total.			Interest.	Sinking Fund.	Income Tax.	Depreciation & Renewal	Sundries.	Total.	
Aberdeen	16,734	6,548	6,008	9,361	38,651	28,036	4,134	10,985	3,515	...	16,737	933	32,170	...
Ayr	3,295	1,813	1,150	2,005	8,263	6,950	70	2,400	958	303	2,367	...	6,028	+ 992
Birmingham ...	27,311	9,298	6,028	25,602	68,239	68,185	...	18,447	6,547	...	14,660	16,531	56,185	+ 12,000
Blackburn	11,779	3,016	7,373	11,018	33,186	21,766	...	7,583	12,878	448	...	345	21,254	+ 512
Blackpool	10,648	3,646	6,199	9,399	29,892	21,614	3,480	8,590	6,349	113	6,042	...	21,094	+ 4,000
Bolton	25,322	6,443	13,209	16,589	61,563	49,731	753	12,993	13,573	..	14,693	146	41,405	+ 9,079
Bradford	62,245	19,909	31,785	45,644	159,583	72,524	3,232	25,020	29,484	2,543	4,536	4,173	65,756	+ 10,000
Brighton	13,047	3,652	6,558	11,243	34,500	16,153	...	8,579	5,164	...	...	...	13,743	+ 2,410
Burnley	14,251	4,833	6,971	15,237	41,292	21,512	...	5,855	4,834	...	8,766	2,057	21,512	...
Burton-on-Trent...	4,738	1,634	1,721	2,845	10,938	4,594	418	2,004	1,978	...	1,000	907	5,889	− 877
Bury	11,719	3,877	4,018	8,471	28,085	22,564	244	7,658	5,253	385	2,500	6,002	21,798	− 1,715
Chester	2,752	1,309	506	1,946	6,513	4,090	...	2,436	1,287	..	367	...	4,690	...
Chesterfield ...	2,691	635	769	1,882	5,977	5,515	...	4,060		133	...	...	4,193	+ 1,322
Colchester	3,669	1,285	1,169	3,117	9,240	2,127	...	2,485	1,732	...	...	...	4,217	− 2,090
Croydon	17,515	4,862	6,798	12,597	41,772	20,294	401	6,238	4,804	600	9,053	...	20,695	...
Darlington	3,551	671	881	2,235	7,338	3,805	35	2,437	1,941	...	...	...	4,398	− 558
Darwen	3,208	731	1,900	2,780	8,619	5,389	...	2,407	2,048	...	1,050	...	5,505	− 116
Derby	E 11,179 H 1,497	2,043 163	2,055 337	7,111 2,929	22,388 4,926	16,041 ...	548	5,657	2,387	...	...	615	8,659	+ 7,930
Doncaster	3,509	994	1,634	3,597	9,734	2,633	...	2,651	1,249	95	...	...	3,995	− 1,362
Douglas (I.O.M.) ...	4,019	1,756	2,546	5,322	13,643	7,891	...	1,959	885	...	2,000	2,650	7,494	+ 397
Dundee	14,020	3,748	6,138	11,498	35,404	22,268	...	8,236	5,330	300	8,316	..	22,182	+ 86
East Ham	12,901	3,039	6,185	6,847	28,972	18,116	583	5,632	5,054	248	...	2,599	13,533	− 104
Gloucester	5,472	1,402	1,527	2,654	11,055	3,978	...	5,363	2,259	...	...	836	8,458	− 4,480
Halifax	19,530	7,616	11,776	18,960	57,882	19,445	1,180	12,782	8,588	457	...	475	22,302	− 1,677
Ilford	8,206	2,430	2,207	4,286	17,129	8,261	1,666	4,804	3,949	...	792	382	9,927	...
Ipswich	7,645	1,732	2,249	4,501	16,127	5,915	...	4,157	1,753	...	...	...	5,910	+ 5
Keighley	2,523	548	465	1,656	5,192	3,048	90	1,331	1,554	...	253	...	3,138	...
Kilmarnock ...	2,990	747	638	1,925	6,300	2,303	...	1,886	151	19	...	652	2,708	− 405
Kirkcaldy	4,330	822	720	3,212	9,084	4,619	...	2,916	2,103	...	409	184	5,612	− 993
Lancaster	2,264	863	673	1,823	5,623	...	90	1,554	1,229	...	...	* 144	...	− 2,837
Leith	8,883	2,482	2,368	4,153	17,886	9,137	62	5,906	6,873	...	...	150	12,929	− 3,729
Lincoln	1,436	844	522	1,027	3,829	2,016	...	1,150	1,368	...	...	...	2,518	− 502
Liverpool	148,668	54,452	82,367	99,918	385,405	185,811	12,403	53,244	56,337	...	55,171	5,877	170,629	+ 27,585
Lowestoft	3,658	859	1,418	3,180	9,115	2,171	.	2,607	1,332	...	...	...	3,939	− 1,768
Maidstone	1,352	656	514	1,509	4,031	1,860	122	983	625	...	...	...	1,608	+ 374
Manchester ...	196,785	63,374	63,270	131,264	454,693	264,980	1,911	50,141	39,594	4,769	87,827	29,560	211,891	+ 55,000
Nelson	2,111	383	868	2,105	5,467	1,852	...	1,072	765	76	...	...	1,913	− 61
Newport (Mon.) ...	7,423	3,039	4,927	6,488	21,877	11,322	2,184	7,838	4,140	99	45	...	12,122	+ 1,384
Nottingham ...	33,457	12,553	12,563	22,483	81,056	58,937	...	15,889	16,493	...	...	2,811	35,193	+ 23,744
Oldham	20,089	4,317	8,148	21,582	54,136	39,942	1,110	12,436	13,227	277	..	6,447	32,387	+ 8,665
Perth...	2,505	677	140	1,741	5,063	3,333	47	2,634	1,892	2	...	...	4,528	− 1,148
Plymouth	6,811	2,728	5,153	7,170	21,862	9,404	1,225	4,624	4,727	...	...	1,278	10,629	...
Rochdale ...	13,656	2,323	4,361	9,165	29,505	24,633	...	10,448	6,907	772	...	3,613	21,740	+ 2,893
Rotherham... ...	7,566	2,215	2,171	6,899	18,851	8,885	1,463	3,737	2,260	...	4,201	150	10,348	...
Salford ...	61,281	14,543	21,165	45,177	142,166	90,385	4,439	20,452	18,691	1,446	14,889	26,346	81,824	+ 13,000
Southampton ..	14,032	4,495	7,024	11,019	36,570	14,434	...	6,222	5,192	212	2,535	273	14,434	...
Southport	4,508	1,648	1,832	3,238	11,226	7,257	6,325	6,434	4,946	...	1,977	150	13,507	+ 75
South Shields ...	5,038	1,852	988	4,260	12,138	11,900	111	4,504	2,859	...	2,531	2,117	12,011	...
Stalybridge, Hyde, Mossley, & D'kinf'd	14,906	3,737	4,117	9,180	31,940	6,865	...	8,949	6,115	...	...	...	15,064	− 8,199
Sunderland ..	18,417	5,406	4,159	12,840	40,822	31,574	704	8,751	9,014	469	6,259	661	25,154	+ 7,124
Wallasey	11,716	3,190	3,346	8,914	27,166	15,718	221	4,873	2,634	...	3,000	553	11,060	+ 4,879
Walsall	6,849	2,418	2,862	3,965	16,094	10,852	1,053	5,099	2,148	269	4,389	...	...	...
Warrington ...	4,996	1,460	2,178	3,813	12,447	7,093	127	3,195	2,715	...	...	...	5,910	+ 1,310
West Ham	39,667	7,858	9,084	15,810	72,419	47,356	162	14,902	7,444	650	7,722	2,810	33,528	+ 13,990
Wigan	15,416	8,038	10,560	14,807	48,821	13,648	...	18,450	10,260	...	...	1,330	30,040	− 16,392
Wolverhampton ..	780 10,014	116 3,313	858 3,793	409 7,417	2,154 24,537	266 19,286	... 719	... 7,808	... 4,130	... ...	... 5,783	... 359	... 18,080	... + 2,191
Yarmouth (Gt.) ...	6,547	1,859	1,922	3,942	14,270	7,632	...	3,376	1,962	...	...	..	5,338	+ 2,294

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast	54,732	12,296	20,277	15,953	103,258	77,881	111	34,339	21,175	...	13,000	...	68,514	+ 9,478
Bexley	3,229	1,314	1,645	2,658	8,846	4,142	127	3,132	1,810	...	...	...	4,942	− 673
Birkenhead ...	15,049	5,092	7,506	5,858	33,505	21,903	...	11,891	9,289	200	317	206	21,903	...
Bournemouth .	22,562	6,175	10,134	14,570	53,441	30,582	1,874	12,185	12,756	...	...	6,664	31,425	+ 1,031
Cardiff	36,893	9,384	11,802	7,094	65,174	49,185	...	23,138	19,729	...	...	1,913	44,780	+ 4,405
Glasgow	245,021	86,791	122,126	31,318	485,256	410,586	3,510	63,769	49,777	9,932	168,408	51,931	343,817	+ 70,279
Huddersfield ...	18,959	3,931	12,086	5,065	40,041	41,155	303	12,185	9,808	806	12,427	1,206	36,432	+ 5,026
Hull	30,592	8,933	21,301	9,352	70,178	51,008	818	12,942	9,528	1,224	10,604	...	34,298	+ 17,528
Leeds	87,112	29,403	37,440	17,255	171,210	156,584	9,512	43,005	38,029	3,946	11,481	373	96,834	+ 69,262
Leicester	41,903	8,823	10,057	8,157	68,940	47,588	551	22,761	11,872	396	13,110	...	48,139	...
London	H 202,483 E 213,906	69,981 88,654	52,221 84,065	259,683 81,478	584,368 468,103	... 356,893	... 4,424	174,778	153,155	1,425	35,000	22,285	386,643	− 25,336
N'castle-on-Tyne...	56,004	16,536	20,482	13,060	106,882	102,572	3,071	34,323	34,255	4,366	335	3,924	75,959	+ 28,440
Northampton ...	E 5,763 H ...	1,894 ...	1,339 ...	2,290 ...	11,286 1,245	10,798 ...	110 ...	... 4,353	... 3,728	... ..	... 1,355	... 472	... 9,908	... + 1,000
Portsmouth ...	26,501	7,660	6,029	5,565	45,755	56,259	353	19,697	16,217	1,109	6,261	4,303	47,587	+ 9,025
Preston	10,071	4,505	4,004	2,203	20,783	17,163	...	5,822	5,773	..	5,568	...	17,163	..
Reading	8,515	3,725	2,618	3,405	18,263	15,370	...	6,558	5,607	145	3,060	...	15,370	...
Sheffield	97,590	20,245	29,662	20,922	168,419	111,167	812	41,393	25,716	2,203	20,000	2,000	91,312	+ 20,667

H—Horse lines. E—Electric trolley lines. * Deficit on Revenue Account.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Appropriation of Net Surplus. Carried Forward.	Reserve.	Relief of Rates.	Population Served.	Car Mileage.	Passengers Carried.	Passengers Carried per Car Mile.	Average Fare per Passenger. d.	Average Journeys per Head of Populat'n per Annum.	Average Car Miles per Day per Car.	Average Total Revenue per Car Mile. d.	Average Traffic Revenue per Car Mile. d.	Traffic Revenue per Mile of Single Track.	Average Traffic Revenue per Annum per Head of Populat'n Served.	Operating Expenses per Passenger. d.	Percentage of Operating Expenses to Total Revenue. %
Aberdeen ...	..	...	...	167,000	1,529,682	17,676,008	11·55	·95	105·84	95	11·112	10·332	2,522	8/4	·52	54·57
Ayr... ...	...	992	...	33,000	378,884	3,603,789	9·51	·98	109·20	104	9·637	9·294	1,520	8/11	·55	54·31
Birmingham ...	12,000															
Blackburn ...	512	...	...	200,000	1,002,372	10,094,028	10·07	1·25	50	105	13·15	12·64	2,219	5/3	·80	61·01
Blackpool ...	...	...	4,000	...	958,836	8,304,218	8·66	1·58	...	109	12·89	12·65	2,380	...	·864	58·04
Bolton	...	...	9,079	221,000	2,411,969	23,410,690	9·70	1·14	105·93	111·21	11·07	11·03	2,650	10/5	·63	55·40
Bradford	...	...	10,000	324,000	5,167,261	46,728,977	9·043	1·17	144	104·09	10·78	10·566	2,347	11/5	·819	68·76
Brighton	2,410	...	...	128,095	1,118,590	10,759,310	9·62	1·09	84	87·68	10·86	10·49	2,844	7/8	·77	68·11
Burnley	...	...	...	165,000	1,205,830	11,967,498	9·92	1·31	73	100	12·50	12·35	3,159	7/6	·83	65·86
Burton-on-Trent	...	...	...	52,000	421,317	3,383,527	8·03	1·072	65	58	8·85	8·60	1,529	5/10	·78	70·42
Bury	...	...	2,725	124,726	1,276,227	9,944,897	8	1·22	79·73	123·33	9·525	9·500	1,854	8/1	·677	55·45
Chester	...	...	...	38,309	291,555	2,532,778	8·687	·97	66·12	92	8·731	8·460	2,854	5/4	·62	63
Chesterfield ...	922	...	400	38,000	275,417	2,302,097	8·36	1·13	60	125	10·01	9·58	1,900	5/9	·62	53
Colchester ...	...	...	...	40,540	353,331	2,514,589	7·11	1·02	62·02	86	7·721	7·327	1,522	5/4	·88	81·5
Croydon	...	...	...	154,342	1,502,408	13,514,918	8·99	1·08	87·56	103	9·915	9·76	3,125	7/11	·742	66·87
Darlington ...	...	...	...	50,000	372,912	3,169,036	8·5	·82	63·38	92·9	7·171	6·964	1,217	4/4	·556	65·85
Darwen	...	...	...	41,864	240,893	2,562,234	10·63	1·2	61	71·09	13·956	13·277	1,861	6/4	·807	61·53
Derby	7,930	...	...	124,000	E. 849,248 H. 109,053	8,381,460 1,004,914	9·869 9·222	1·075 ·999	75·70	...	10·86 9·529	10·614 9·205	...	6/9	·64 1·17	58·26 113·71
Doncaster ...	...	...	...	41,500	495,404	2,753,506	5·55	1·05	66·35	122	5·991	5·828	1,143	5/9	·85	78·71
Douglas (I.O.M.)	397	...	...	...	H. 286,513 C. 121,333	2,161,667 700,227	7·017	1·696	...	70 Sum. 79 ,,	12·672	11·899	3,235	...	1·144	63·36
Dundee	...	86	...	164,500	1,162,792	15,554,905	13·3	·878	93	81	11·903	11·748	2,323	6/11	·546	61·38
East Ham ...	...	...	5,270	125,000	1,062,151	15,049,240	14·1	·74	120	108	10·64	10·492	3,638	7/5	·50	61·53
Gloucester ...	...	...	...	50,715	519,996	3,182,111	6	1·06	62·75	94·93	6·938	6·55	948	5/7	·83	73
Halifax	...	...	...	178,000	1,624,275	18,899,242	11·62	·97	106	78	11·425	11·228	1,474	8/6	·735	74·85
Ilford	...	...	...	70,000	645,117	6,586,754	10·2	·89	94	126	9·446	9·106	2,156	7/-	·624	67·46
Ipswich	5	...	...	73,000	654,253	5,289,006	8·08	·965	75·56	70·65	8·086	7·8	1,429	5/10	·73	73·16
Keighley	...	...	...	42,000	256,715	1,935,098	7·50	·994	46·07	100·41	7·704	7·497	1,312	3/10	·644	62
Kilmarnock ...	...	...	...	36,000	328,829	2,331,277	7·09	·84	64·76	98·80	6·279	6·018	1,492	4/7	·654	73·75
Kirkcaldy ...	...	...	...	34,063	466,919	4,640,618	9·939	·692	136·2	53	7·556	7·289	1,734	7/9	·47	66·29
Lancaster ...	...	...	...	44,600	194,577	1,353,681	6·96	·950	30·35	92	6·759	6·611	1,117	2/5	·997	108
Leith	...	...	...	113,251	861,162	8,519,563	9·9	·74	75·23	112	7·531	7·352	2,208	4/8	·504	66·22
Lincoln	...	...	...	52,500	137,186	1,437,946	10·48	·95	27·39	55	10·226	10·044	1,938	2/2	·64	65·50
Liverpool ...	...	...	27,585	770,000	12,115,934	122,094,528	10·07	1·108	158·56	106	11·315	11·168	5,421	14/8	·766	67
Lowestoft ...	...	...	...	31,000	343,190	2,622,922	7·64	1·00	84·61	67	7·89	7·65	1,827	7/-	·83	87·64
Maidstone ...	374	...	...	13,000	157,050	1,186,566	8·85	1·14	91·27	92·5	9·002	8·633	710	8/8	·81	68·44
Manchester ...	...	...	55,000	800,000	15,523,459	143,264,501	9·23	1·19	179	100	11·12	11·02	4,556	17/10	·76	63·18
Nelson	...	...	...	42,000	203,203	2,035,300	10·01	·86	48·46	93	8·645	8·580	1,881	3/5	·645	74·70
Newport (Mon.)...	1,384	...	...	75,000	772,753	7,760,404	10·04	1·007	100·81	100	10·311	10·108	2,245	8/8·15	·677	65·90
Nottingham ...	...	6,744	17,000	254,568	2,731,552	31,218,691	11·43	1·06	123	95·50	12·30	12·13	3,863	10/10	·62	58
Oldham	...	3,665	5,000	160,000	1,818,444	18,647,731	10·25	1·19	116·55	104	12·416	12·243	2,604	11/7	·697	57·54
Perth	...	...	...	34,000	229,551	1,681,188	7·32	1·14	49·45	91	8·779	8·349	939	4/8	·723	60·3
Plymouth ...	...	...	...	118,000	721,115	7,324,347	10·157	1·024	62·07	90	10·406	10·403	2,084	5/4	·72	69·92
Rochdale	2,893	...	...	102,614	1,201,364	9,749,202	8·11	1·32	95	105	10·814	10·753	1,804	10/6	·73	55
Rotherham ...	...	...	...	61,500	618,211	5,743,298	9·29	1·125	93·39	109·56	10·767	10·450	2,692	8/9	·788	67·97
Salford	...	...	13,000	350,000	5,268,933	43,614,123	8·27	1·27	124·6	115·5	10·594	10·594	3,102	13/3	·782	59·99
Southampton ...	...	...	...	117,300	1,143,085	9,437,396	8·256	1·251	80	70	10·709	10·421	3,050	8/6	·93	71·70
Southport ...	75	...	...	31,312	447,821	4,068,131	9·08	1·07	129·9	102·5	9·905	9·741	1,691	11/7	·66	60
South Shields ...	...	...	...	112,000	559,948	5,654,929	10·09	1·01	50·48	99	10·30	10·28	2,337	4/3	·515	50·59
Stalybridge, &c.	...	...	...	92,811	1,422,122	9,780,464	6·877	·951	101·88	95·03	6·548	6·542	1,399	8/4	·784	82·3
Sunderland ...	...	...	7,124	170,000	1,535,425	17,483,132	11·38	1·006	102	76·8	11·314	11·261	3,687	8/6	·56	55·66
Wallasey ...	1,539	...	3,340	65,000	862,123	7,995,451	9·27	1·27	123	81·4	11·94	11·76	3,330	13/-	·816	62·60
Walsall	...	...	...	100,000	611,687	4,814,657	7·592	1·316	48	102	10·572	10·358	1,955	5/3	·82	59·727
Warrington ...	...	1,310	...	83,000	429,786	4,965,296	11·55	·93	59·82	103·42	10·911	10·724	1,989	4/7	·60	63·7
West Ham ...	4,322	...	9,668	308,284	2,556,854	35,502,836	13·88	·789	115	87	11·243	10·963	5,159	7/7	·492	60·00
Wigan	...	...	...	61,000	1,452,458	11,269,947	7·76	1·26	185	83	10·32	10·09	2,456	20/-	1·04	78
Wolverhampton	2,191	...	...	100,900	966,133	9,276,023	9·601	1·179	91·93	90	10·886	10·727	1,763	9/-	·691	57·72
Yarmouth (Gt.) ...	2,294	...	...	35,000	601,535	4,296,953	7·143	1·199	122·77	73·97	8·737	8·534	1,775	12/3	·798	65·15

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

Belfast	516	...	8,962	349,180	5,296,895	42,945,849	8·11	·99	123	128	8·21	8·06	2,473	10/4	·58	57
Bexley	...	...	...	16,300	268,619	1,737,204	6·46	1·70	106·58	...	11·604	10·202	1,652	14/-	1·22	68·11
Birkenhead ...	...	...	...	117,000	1,324,743	11,696,691	8·82	1·113	100·83	83·32	10·038	9·829	2,261	9/3	·687	60·84
Bournemouth ...	1,031	...	...	100,000	1,765,098	13,503,610	7·65	1·48	135	92	11·42	11·37	2,860	16/9	·95	63·65
Cardiff	4,405	...	...	164,333	2,624,504	24,438,164	9·31	1·046	148·71	99	10·893	9·744	2,910	12/11	·653	55·83
Glasgow	...	25,279	45,000 *	1,050,000	20,350,367	224,063,098	11·01	·95	213	101·20	10·565	10·465	5,035	16/11	·52	53·96
Huddersfield ...	5,026	...	...	120,000	1,794,691	15,252,150	8·50	1·22	127	112	10·79	10·38	2,770	13/-	·63	49·32
Hull	15,000	...	2,528	266,762	2,956,406	29,151,543	9·86	1·00	109	113·68	9·84	9·84	4,456	9/1	·58	57·89
Leeds	...	...	69,262	463,495	7,454,321	73,024,853	9·92	1·065	157·55	111·38	10·69	10·56	3,352	14/-	·563	52·23
Leicester	...	...	...	232,111	3,331,998	27,467,984	8·243	1·002	118	99	8·393	8·265	3,101	9/11	·60	59
London	...	...	...	...	H 13,862,718 E 16,267,579	131,165,027 183,062,063	9·46 11·25	1·04 1·06	... ...	82 106	10·093 12·171	9·828 11·955	5,762 6,944	... ...	1·069 ·614	100·24 56·74
N'castle-on-Tyne	...	14,856	13,584	300,000	4,263,174	45,506,468	10·67	1·11	152	106	11·75	11·56	3,871	13/8	·57	50·84
Northampton ...	... ...	... ...	1,000 ...	90,000 ...	E. 541,715 H. 31,864	5,216,883 184,072	9·63 7·77	·99 1·00	60 ...	90 ...	E. 9·78 H. 6·46	9·53 5·80	2,459 ...	4/11 ...	·519 1·624	E. 51·10 H. 145·27
Portsmouth ...	4,025	...	5,000	202,000	2,199,823	20,668,825	9·40	1·15	102·32	83	11·129	10·791	3,471	9/9	·531	44·85
Preston	...	...	...	120,000	904,582	8,459,742	9·35	1·072	70·5	132·92	10·068	10·028	2,197	6/3	·59	54·77
Reading	...	...	...	80,000	918,825	8,130,179	8·84	·96	110	112	8·78	8·53	2,476	7/10	·53	54
Sheffield	...	...	20,667	447,951	6,804,656	73,966,299	10·870	·898	165	104·6	9·861	9·767	4,174	12/4	·546	60·24

* Applied as special depreciation. H—Horse lines. E—Electric trolley system.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Average Operating Expenses per Car Mile (excludi'g Power Cost). d.	Average Operating Expenses per Car Mile (including Power Cost). d.	Average Number of Cars in Use Daily.	Number of Cars in Stock.	Average Speed per Hour. Miles.	Average Car Hours per Day.	Average Distance of 1d. Fare. Miles.	Average Fare Charged per Mile. d.	Operating Expenses per Car Mile. Traffic. d.	General. d.	Repairs and Mainten-ance. d.	Power. d.	Total. d.	Board of Trade Units.	Cost per Board of Trade Unit. d.	Board of Trade Units used per car mile.
Aberdeen	4·595	6·064	44	69	7	704	1·31	·81	2·625	1·027	·943	1·469	6·064	1,906,218	1·17	1·25
Ayr	3·964	5·234	10	19	8	130	1·25	·75	2·087	1·148	·729	1·270	5·234	375,436	1·28	·99
Birmingham ...																
Blackburn	5·38	8·02	26	48	7·50	364	1·25	·76	2·82	·72	1·76	2·64	7·94	1,853,272	1·43	1·84
Blackpool	5·13	7·48	24	61	6	400	...	...	2·67	·91	1·55	2·35	7·48	1,261,946	1·79	1·31
Bolton	4·47	6·12	58	96	7½	932	1·40	·70	2·518	·639	1·313	1·656	6·126	3,619,390	1·10	1·50
Bradford	5·292	7·412	136	239	7·20	2,040	1·59	·501	2·891	·925	1·476	2·120	7·412	9,582,871	1·14	1·8
Brighton	4·99	7·40	32	50	6¼	512	1·31	·72	2·799	·784	1·407	2·412	7·402	1,798,905	1·50	1·61
Burnley	5·18	8·218	27	46	7	405	1·25	·83	2·836	·963	1·387	3·032	8·218	2,525,135	1·45	2·08
Burton-on-Trent...	4·61	6·23	9·79	20	6⅝	181	1·35	·70	2·70	·93	·98	1·62	6·23	551,758	1·385	1·16
Bury	3·689	5·282	...	47	7·56	...	1·22	·83	2·204	·729	·756	1·593	5·282	2,042,840	·99	1·6
Chester ...	3·762	5·364	6·4	13	8	115	1·27	·79	2·265	1·078	·419	1·602	5·364	266,856	1·75	·91
Chesterfield ...	3·56	5·20	6	12	7·15	108	1·38	·75	2·344	·554	·670	1·641	5·209	361,421	1·25	1·31
Colchester	4·159	6·276	10·68	18	6·12	171	1·13	·97	2·492	·873	·794	2·117	6·276	498,758	1·50	1·41
Croydon	4·661	6·673	48	60	6·85	725	2·15	·52	2·798	·777	1·086	2·012	6·673	1,511,590	2·00	1·006
Darlington	3·284	4·723	11	16	6½	151	1·098	·82	2·285	·432	·567	1·439	4·723	429,105	1·25	1·15
Darwen	5·817	8·587	6	17	8·75	108	1·05	·81	3·196	·728	1·893	2·770	8·587	395,096	1·75	1·64
Derby	E. 4·318 H. ...	6·327 10·837	... ...	39 5	... ...	... ...	... ...	... ...	3·16 3·294	·577 ·358	·581 ·741	2·009 6·444	6·327 10·837	1,137,705	1·50	1·34
Doncaster	2·974	4·716	13	25	7·5	222	1·25	·8	1·7	·482	·792	1·742	4·716	575,470	1·50	1·16
Douglas (I.O.M.) ...	4·897	8·029	H 24 Sum. C 9 ,,	43 14	6	...	1·5 1·37	1·23 Sum. 1·45 ,,	2·365	1·033	1·499	3·132	8·029			
Dundee	4·934	7·307	42	60	6·2	528	1·468	·786	2·893	·774	1·267	2·373	7·307	2,207,559	1·25	1·8
East Ham	4·999	6·546	25	40	7	448	1·57	·64	2·915	·687	1·397	1·547	6·546	1,095,511	1·5	1·03
Gloucester	3·87	5·10	15	30	6·78	217	1·50	·62	2·526	·646	·705	1·225	5·102	637,491	1·00	1·21
Halifax	5·751	8·552	57	96	7·2	912	1·30	·77	2·886	1·125	1·740	2·801	8·552	3,033,499	1·50	1·87
Ilford	4·778	6·372	14	22	7·5	241	1·373	·74	3·053	·904	·821	1·594	6·372	897,916	1·146	1·392
Ipswich	4·265	5·916	19	36	6·30	216	1·53	·693	2·805	·635	·825	1·651	5·916	720,246	1·50	1·101
Keighley	3·306	4·854	7	12	7·61	126	2·35	·994	2·359	·513	·434	1·548	4·854	227,137	1·75	·88
Kilmarnock ...	3·193	4·598	9·11	14	7·43	121	1	·97	2·182	·545	·466	1·405	4·598	369,551	1·25	1·12
Kirkcaldy	3·305	4·956	18	22	6½	184	1·50	·64	2·437	·462	·406	1·651	4·956	685,269	1·125	1·467
Lancaster	4·687	6·936	6	12	8	96	1·019	·959	2·793	1·064	·830	2·249	6·936	240,820	1·817	1·238
Leith	3·828	4·985	21	37	7	315	1·56	·63	2·476	·692	·66	1·157	4·985	971,699	1·026	1·13
Lincoln	4·903	6·699	4	8	7	72	1·75	·428	2·513	1·477	·913	1·796	6·699	164,314	1·50	1·197
Liverpool	5·655	7·635	389	494	8	5,446	2·375	·43	2·945	1·079	1·631	1·980	7·635	20,381,934	1·177	1·682
Lowestoft	4·15	6·37	14	19	8	196	univ'rs'l p	enny fare	2·56	·60	·99	2·22	6·37	356,551	2·14	1·04
Maidstone	3·854	6·160	5	7	6·4	71·66	1	1	2·066	1·002	·786	2·306	6·16	206,932	1·75	1·31
Manchester ...	5·00	7·03	425	566	7·37	6,175	2·12	·56	3·04	·98	·98	2·03	7·03	25,072,791	1·259	1·61
Nelson	3·971	6·457	6	9	10	108	1	1	2·494	·452	1·025	2·486	6·457	252,546	2	1·24
Newport (Mon.) ...	4·779	6·794	26	40	6·67	390	1·62	·61	2·305	·944	1·530	2·015	6·794	1,153,398	1·35	1·49
Nottingham ...	5·14	7·12	77	115	6·50	15	1·62	·65	2·94	1·10	1·10	1·98	7·12	4,316,656	1·25	1·61
Oldham	4·297	7·145	48	80	6·50	864	1·12	·871	2·652	·570	1·075	2·848	7·145	3,453,037	1·50	1·89
Perth...	3·473	5·294	8	12	6·25	120	1·01	1·073	2·619	·708	·146	1·821	5·294	279,694	1·49	1·21
Plymouth	4·999	7·276	28	42	7·25	336	1·75	·75	2·267	·908	1·715	2·386	7·276	938,006	1·75	1·34
Rochdale	4·065	6·028	33	59	7	495	1·14	·95	2·725	·462	·878	1·828	5·893	1,896,278	1·16	1·69
Rotherham ...	4·640	7·318	17	31	8	272	1·6	·62	2·937	·860	·843	2·678	7·318	1,103,804	1·50	1·785
Salford	4·418	6·476	125	177	7·75	2,125	1·50	·59	2·791	·662	·965	2·058	6·476	7,983,603	1·358	1·53
Southampton ...	5·366	7·679	45	51	7	557	1·25	·75	2·947	·944	1·475	2·313	7·679	1,333,050	1·98	1·17
Southport	4·282	6·017	14	26	6·5	210	1·3	·72	2·415	·883	·981	1·735	6·016	504,385	1·50	1·16
South Shields ...	3·37	5·20	15	35	6·89	222	1·50	·62	2·16	·79	·42	1·83	5·20	710,234	1·44	1·27
Stalybridge, etc....	3·840	5·389	41	55	6·75	577	1·24	·8	2·515	·630	·695	1·549	5·389	2,203,128	1·0	1·549
Sunderland ...	4·374	6·379	45	70	7	726	1·44	·68	2·879	·845	·650	2·005	6·379	1,826,167	1·69	1·18
Wallasey	5·082	7·562	29	35	7	435	1·50	·62	3·26	·89	·931	2·48	7·562	1,316,215	1·62	1·52
Walsall	4·760	6·314	17	28	7	255	1·24	·83	2·687	·949	1·123	1·555	6·314	662,582	1·50	1·083
Warrington ...	4·821	6·950	11·386	21	6·46	182·17	1·25	·803	2·790	·815	1·216	2·129	6·950	610,115	1·50	1·42
West Ham	5·314	6·798	80	100	6⅝	1,040	1·85	·56	3·723	·738	·853	1·484	6·798	3,797,337	·99	1·48
Wigan	5·62	8·07	48	67	8	960	1	1	2·543	1·33	1·75	2·45	8·07	2,369,000	1·50	1·63
Wolverhampton ...	4·252	6·095	30	43	6½	420	1·125	·867	2·487	·823	·942	1·843	6·095	1,582,325	1·125	1·638
Yarmouth (Gt.) ...	4·12	5·693	22	31	6	324	1	1	2·612	·742	·766	1·573	5·693	539,902	1·75	·897

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION AND LIGHTING PURPOSES.

															Works Cost.	
Belfast	3·96	4·68	199	232	8·75	1,931	2·33	·40	2·48	·56	·92	·72	4·68	6,434,835	·59	1·21
Bexley	5·529	7·904	...	16	7·5	...	1·31	·80	2·885	1·174	1·470	2·375	7·904	408,497	1·561	1·52
Birkenhead ...	5·009	6·07	43·55	59	7·128	509	1·38	·64	2·727	·922	1·360	1·061	6·070	2,398,274	·58	1·81
Bournemouth ...	5·29	7·27	57	81	6·61	1,026	1·16	·87	3·07	·84	1·38	1·98	7·27	2,676,833	1·306	1·51
Cardiff	5·311	5·95	87	130	6·50	1,104	2	...	3·374	·858	1·079	·64	5·95	4,842,074	·35	1·84
Glasgow	5·353	5·721	543·98	780	7·91	7,616	2·29	·45	2·890	1·023	1·440	·369	5·721	24,974,056	·301	1·23
Huddersfield ...	4·65	5·32	44·25	70	6·6	708	1·25	·82	2·52	·52	1·61	·67	5·32	3,722,598	·33	2·04
Hull	4·93	5·69	71·25	116	10	1,140	2·75	·36	2·48	·73	1·72	·76	5·69	3,582,831	·63	1·21
Leeds	5·02	5·58	186	270	7·21	2,790	1·95	·54	2·84	·96	1·22	·56	5·58	13,091,475	·32	1·78
Leicester	4·377	4·965	92	140	8	1,472	2·15	·493	3·018	·635	·724	·588	4·965	5,349,665	·358	1·60
London	H 5·622 E 5·704	10·117 6·906	466 420	723 671	6 8·5	6,291 6,300	... ...	... ...	3·506 3·156	1·212 1·308	·904 1·240	4·495 1·202	10·117 6·906	32,782,702	·596	2·02
N'castle-on-Tyne...	5·23	6·04	111	187	7	1,665	1·58	·65	3·15	·93	1·15	·74	5·97	7,659,050	·41	1·80
Northampton ...	3·99	5·00	16·50	22	5·6	264	1·34	·68	2·55	·85	·59	1·01	5·00	878,889	·625	1·62
Portsmouth ...	4·384	4·991	73	100	6	15	1·50	·85	2·891	·835	·658	·607	4·991	2,230,460	·599	1·378
Preston	4·929	5·514	20	30	7·36	360	1	·95	2·671	1·195	1·063	·585	5·514	1,461,304	·362	1·409
Reading	3·88	4·77	25	36	7	400	1·47	·69	2·224	·973	·684	·889	4·770	1,090,416	·75	1·053
Sheffield	5·202	5·940	178·23	263	6·727	2,940	2·50	·38	3·442	·714	1·046	·738	5·940	11,546,500	·391	1·697

C—Cable line. E—Electric trolley system. H—Horse lines. * And general.

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RATING OF LIGHT RAILWAYS.

JUDGMENT BY HOUSE OF LORDS.

The House of Lords on May 8 gave judgment in the appeal of Wakefield Corporation *v.* Wakefield and District Light Railways Company. The point involved in the case which has been frequently reported when before the courts below, was the important question whether light railways laid on public roads by authority granted under the Light Railways Act, should be rated on their full net annual value, or only on one-fourth of that value, as in the case of railways, the reductions for railways being made under the provisions of the Public Health Act, 1875. The light railways in question are laid in the streets of Wakefield. The local justices held that the respondents were liable to pay on the full net annual value. The King's Bench Division, on appeal, reversed this judgment, and found that the liability was only on one-fourth of the net annual value. The Court of Appeal took the same view, and the Corporation appealed to the House of Lords.

The Lord Chancellor, in giving judgment, said it was clear the structure was a railway, and that it was constructed under the powers of an Act of Parliament. He did not think it necessary to repeat what the judges in the courts below had said. The only point on which there could be any difficulty was the question whether the land was used only as a railway. He thought the user referred to in the Public Health Act was the user by the occupier who was to be rated. In these circumstances, the view of the Court of Appeal should prevail, and the judgment of that court should be affirmed. Lord Macnaghten, Lord James, and Lord Atkinson said that they were of the same opinion, and the appeal was accordingly dismissed.

UNDERGROUND RAILWAYS COMPANY.

An extraordinary meeting of the Underground Electric Railways Company of London, Limited, was held on May 11, for the purpose of considering the scheme for dealing with the company's profit-sharing notes. Sir Edgar Speyer, who presided, addressed the meeting at great length. He said that the result of their six years' labours had been very disappointing. The adverse circumstances with which they had had to contend included unfavourable money markets, delays in completion of the railways, and added capital expenditure owing to the requirements of the local authorities. They had also suffered from the introduction of motor omnibuses, which, without benefiting themselves, had caused heavy losses to others. The extent to which fares had been reduced was another trouble. The burden of rates and taxes was severe and unwarranted. The rates and taxes paid by London underground railway companies during six months were the following percentages of their gross receipts: Metropolitan District, 9; Baker Street and Waterloo, 6·1; Great Northern, Piccadilly, and Brompton, 5·99; Charing Cross, Euston, and Hampstead, 5·65; City and South London, 3·48; Central London, 10·96; Great Northern and City, 4·53; Metropolitan, 6·88. The net surplus of the Baker Street and Waterloo, the Piccadilly, and the Hampstead Railways, after paying fixed charges for the half-year ended December 31 last, was £9,319, while the rates and taxes paid for the same period was £15,572. He protested against such treatment, and said there was a very strong case for the total exemption of underground railways from local taxation, except in respect of their surface works. The expectations as to traffic when the company began were too sanguine, but it seemed probable that the uneconomic period would soon come to an end. The fares to be charged by railways, tramways, and omnibuses were still in an experimental stage, and the time could not be far distant when they would come to a fair and remunerative basis. There might be a pooling of all the transportation companies' earnings, with one central management. He subsequently advocated the formation of the Traffic Board recommended by the Royal Commission, and then said that their undertaking from the engineering side had been an unqualified success. A great increase of traffic would come to the four railways in which they were interested, as the lines became better known, as the population increased, and as monetary stringency passed away. Sir Edgar then explained the scheme (details of which have been published) for the issue of £1,000,000 5 per cent. prior lien bonds, £3,000,000 four and a half per cent. bonds, and £3,200,000 six per cent. income bonds, and for the exchange of certain of these securities for the £7,000,000 of profit-sharing notes, with arrangements for meeting interest. The scheme was unanimously adopted.

German Railway Electrification.—It is announced that the Prussian State Railway authorities intend to adopt electric traction on lines from Leipzig to Magdeburg (80 miles), and from Leipzig to Halle (23 miles). This decision follows on experimental electric running for some months on Berlin suburban lines. It is proposed to run shorter but more frequent trains than has been the case with steam traction. Careful records are to be kept, so that the comparative cost of steam and electric working may be ascertained.

FINANCIAL REPORTS.

Kalgoorlie Electric Tramways (W.A.).—The report for 1907 shows that the gross receipts were £48,008, as compared with £51,379 for the previous year, while the net profits amounted to £16,270, against £17,546 for 1906.

Loss at Heywood.—On the past year's working of Heywood municipal tramways there has been a loss of over £1,000. The Electricity and Tramways Committee have resolved to ask the Finance Committee for a sum equal to a penny rate towards the loss.

South Shields Corporation Tramways.—For the past financial year the revenue was £29,762, and the working expenses were £18,003. The gross surplus of £11,759 shows a slight decrease as compared with the previous year. After paying debt charges, there is a net balance of £2,884.

Coventry Electric Tramways.—The directors announce a dividend of 3½ per cent. (7s. per share) for the year, carrying £3,900 to reserve for depreciation and £114 forward. The directors propose to apply £4,000 in reducing the company's indebtedness to New General Traction Company, Limited.

Blackpool Corporation Tramways.—The report for the year ended March 31 last states that 168,212 fewer passengers were carried than in the previous year and 15,567 fewer car miles run. The income was £53,740, against £56,586 in the previous year, and the disposable balance, after paying all expenses, was £6,410, against £10,042.

Preston Tramways.—A statement submitted by Councillor Crompton to Preston Town Council shows that the tramway receipts for the past financial year amounted to £38,256. After paying working expenses, the gross surplus was £15,190. After paying debt charges, etc., there is a profit of £3,187, which is transferred to the depreciation fund.

Kidderminster Tramways.—The gross receipts of the Kidderminster and Stourport Electric Tramway Company for the year amount to £6,334, being a decrease of £18 as compared with 1906, and the expenses to £3,268, an increase of £67. The profit has been applied as follows: To reserve and renewals fund, £500; to dividend at the rate of 4½ per cent., £2,574; leaving to be carried forward, £31.

Newcastle Tramways.—Mr. Ernest Hatton, engineer and general manager of Newcastle Corporation Tramways, in a return made to the Tramways Committee for the year ended March 31 last, states that the traffic receipts were £205,322, equal to 11·17d. per car mile, as compared with £205,262 or 11·56d. per car mile in the previous year. The working expenses were £116,852, against £107,319. After paying debt charges, the net surplus was £19,478.

Merthyr Electric Traction and Lighting Company.—The report for 1907 shows that the gross receipts were £17,344. After deducting all expenses, including debenture interest, and placing £1,000 to the renewals provision account, there remained £4,347, making, with £436 brought forward, £4,783. The preference dividend has been paid and the directors recommended a dividend of 5 per cent. on the ordinary shares, leaving £533 to be carried forward.

Results in Bury.—At a meeting of Bury Tramways Committee it was reported that the net profits on the Bury sections of the tramways for the past year were estimated at £4,606, as compared with £5,225 for the previous year. The manager pointed out that the falling off was accounted for by the fact that the financial year just completed did not include any Easter holidays. It was decided to allocate the profits to the rates and the reserve fund.

Tynemouth and District Electric Traction Company.—The total revenue for 1907 was £12,846. The directors propose to place £572 to provision for renewals, and recommend the following allocation: Depreciation and reserve account (it will then amount to £9,069), £500; capital redemption fund, £500; dividend at the rate of 5 per cent. per annum on the cumulative preference shares, £1,525; dividend at the rate of 4 per cent. per annum on the ordinary shares, £1,856; balance to carry forward, £226.

Johnson and Phillips, Limited.—The directors' report states that the profit for the past year amounted to £31,529, which with £11,451, the balance brought forward, makes £42,981. From this is deducted depreciation on buildings and interest on debenture stock and £500 written off investments, leaving an available balance of £27,123. The directors propose a dividend at the rate of 7 per cent. on the ordinary shares, and £8,000 is transferred to reserve, leaving a balance of £6,873 to be carried forward.

Northampton Tramways.—The accounts for the year ended March 31 last show that the receipts were £21,940, against £22,084 in the previous year, and the working expenses were £13,236, against £12,532. After meeting capital charges there is a net surplus of £1,772, against £2,355. Out of the surplus, £500 is paid in relief of rates, and the balance is carried to reserve fund, raising it to £4,814. The working expenses for the electric cars are equal to 5·26d. per car mile, or an increase of ·26d., entirely due to higher cost for power and for repairs.

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Potteries Electric Traction Company.—The directors' report for 1907 states that the revenue amounted to £111,670, being an increase of £2,404. After deducting expenses, including £11,381 for debenture and other interest, there remains a surplus of £27,874. To this has to be added £616, brought forward. The directors recommend to place to renewal fund £3,500; to place to depreciation and reserve account £2,500; a dividend at the rate of 4 per cent. per annum on the ordinary shares, and to carry forward £441. The depreciation and reserve account will then stand at £19,000.

First Year's Profits at Erdington.—At a meeting of Erdington Urban District Council, the report of the Tramways and Electric Light Committee on the working of the tramways for the period from April 22, 1907, when operations began, to March 31, 1908, was submitted. It showed that after paying all expenses there was a profit of £1,960. The gross receipts were £6,254. The Council resolved that out of the surplus, £600 should be placed to a reserve fund and invested in Consols, and that the balance of £1,360 should be paid over in relief of rates.

Loss at Stalybridge.—At a meeting of the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board, Mr. W. E. Wood, chairman of the Finance Committee, said the loss for the past year was a little over £10,000—a considerable reduction on previous losses. Next year they might hope for still better results. It was satisfactory to know that this loss compared well with £16,000 in two former years, and £14,000 in another year. They had turned the corner, and they could look forward to success and prosperity in the near future.

Auckland Electric Tramways Company.—The report for 1907 states that the total revenue amounted to £140,451, and, after deducting expenses and debenture interest, setting aside £10,000 for depreciation, and including £3,101 brought forward, there is a disposable balance of £32,823. The directors propose a dividend at the rate of 6 per cent. per annum on the ordinary shares, transfer 1,000 to reserve, and carry forward £2,165. The Board state that the reduction in the dividend was considered a prudent step, in view of the fact that the new capital recently issued has not as yet become remunerative.

Lincoln Corporation Tramways.—The report for the year ended March 31 shows that receipts were £6,048, and the working expenses £3,692. After allowing for capital charges there is a deficit of £148. As these tramways are equipped on the G.B. surface-contact system, it is of interest to note that the working expenses per car mile were 6·1d., compared with 6·7d. in the previous year. Only £54 was spent on maintenance of the G.B. equipment, and most of this was caused by trouble at a railway crossing. The energy consumed per car mile was 1·108 units, compared with 1·197 in the preceding year.

Swansea Improvements and Tramways Company.—The report for the half-year ended December 31, 1907, states with regard to the tramways undertaking, that the directors have decided, in addition to the depreciation and reserve fund, to build up out of each year's revenue a fund for defraying or equalising the cost of extraordinary renewals. They have accordingly set aside out of the year's profits £2,500. The gross receipts amount to £27,816, being an increase of £2,741. A dividend is recommended on the ordinary shares at the rate of 3 per cent. for the year, leaving £1,531 to be carried forward.

Buenos Ayres Tramway Companies.—At a meeting of holders of 5 per cent. conversion debentures stock of the Buenos Ayres Grand National Tramways Company, held in London on May 15, resolutions were adopted authorising an increase in the amount of the stock by £200,000 to provide funds for the completion of the electrification of the lines, for the extension of the system, etc. At a meeting of holders of similar stock in the Buenos Ayres New Tramways Company, it was agreed to increase that stock by £100,000 for like purposes. Meetings of other stockholders of the two companies were also held, and resolutions connected with the joint arrangements were passed.

Leeds Corporation Tramways.—At a recent meeting of Leeds Tramways Committee, Mr. J. B. Hamilton, the general manager, submitted his abstract of results for the year ended March 31 last. The total receipts were £340,368, being an increase of £177,317, and the gross surplus was £163,051. This sum, with minor items, is allocated as follows: Interest on capital, £31,802; income tax, £4,384; contribution to sinking fund, £37,452; permanent way renewals, £21,252; written off provisional orders, £385; transferred to aid of rates, £66,246. The gross surplus of £163,051 is an increase of £6,467 over the previous year, but the amount paid in relief of rates is about £5,000 less than a year ago. This is accounted for by a larger sum having been spent on track renewals.

South Metropolitan Electric Tramways.—The directors' report for 1907 states that the total revenue amounted to £51,370. After deducting expenses, including £6,000 for interest on debenture stock and providing for payments to local authorities under agreements amounting to £1,230, there remains a surplus of £8,477, making, with the balance brought forward, a total of £8,816, which the directors recommend should be appropriated as follows: To the dividend on the preference shares for the year (already paid), £8,386; to be carried forward, £430. Traffic receipts derived from the working of the tramways amounted to £41,413, being an increase of £23,688 over those for the previous year, when the tramways were being opened in sections, consequently no useful comparison is yet available.

Salford Tramways.—Mr. G. W. Holford, general manager of Salford tramways, has presented to the Tramways Committee the accounts for the year ended March 31 last. These show that the total revenue was £244,048, and the working expenses £147,286, leaving a gross surplus of £96,762. After paying £25,985 for rent of lines and £41,971 for interest and sinking fund charges, there was a net surplus of £28,806. Out of this latter amount the Committee propose to pay £18,000 to relief of rates, and to carry the balance to the depreciation and renewals' fund. This fund now stands at £80,000, and the total paid in relief of rates since the beginning of the municipal tramway undertaking is £79,000. The receipts for the year show an increase of £6,000 over those of the preceding twelve months.

South Staffordshire Tramways (Lessee) Company.—The report of the directors for 1907 states that the total revenue, including a dividend of 3 per cent. on the preference shares of the South Staffordshire Tramways Company, amounted to £49,786, against £43,741 for the preceding year. The expenditure (including interest on loans) amounted to £45,562. The profits amount to £4 223, which, with the amount brought forward, makes a total of £4,835. Debenture interest absorbs £1,668 and £500 has been placed to renewals account, leaving a balance available for distribution of £2,667. The directors propose to place to sinking fund £700, to pay a dividend at the rate of 6 per cent. per annum on the cumulative preference shares for the six months ended January 15, 1905, and to carry forward £467.

Lisbon Electric Tramways.—The accounts for 1907 show a net profit of £62,802, which, added to the balance of £15,711 brought forward from last year, gives a balance of £108,514. From this amount £35,000 has been placed to depreciation, and after writing off £9,077 from this account for renewal of permanent way the balance to credit of depreciation reserve account amounts to £135,922. The amount of £5,000 has been added to the credit of exchange reserve account, making the total of this account £20,000. After providing for the above an available balance of £68,514 remains, out of which the usual preference dividend, amounting to £25,533, has been paid, and the directors recommend the payment of a dividend of 5 per cent. on the ordinary share capital, leaving £13,271 to be carried forward.

Perth (W.A.) Electric Tramways.—The eighth annual report of the directors of this company shows that the gross receipts amounted to £75,041, as compared with £78,542 for the previous year. The net profit is £31,176, against £35,260. The discrepancy is largely explained by the fact that an exhibition was held in Perth in 1906. The total expenses in 1907 were £40,732, as against £40,368. A balance of £8,445 is available after payment of interest on sinking fund and debentures. Out of this sum £1,500 has been expended on capital account, and this amount is carried to the reserve account of undivided profits. Of the balance, £1,000 is placed to the cash reserve fund, and £5,000 is the amount of the dividend on the ordinary shares at 5 per cent. The balance carried forward amounts to £945. During the year 1,178,716 car miles have been run, and 7,790,934 passengers have been carried. The earnings per car mile are 15·17d., and the expenses 8·29d.

An Argentine Tramway Trust.—The Campagnie Generale de Tramways de Buenos Ayres, which was formed as a tramway trust about a year ago by Belgian and German capitalists, has issued a statement in which it is said that the company's capital has been devoted to the acquisition of shares in the Anglo-Argentine Tramways Company, the Capital Traction and Electric Company, the Buenos Ayres Grand National Tramways Company, and the Buenos Ayres Electric Tramways Company (1901). In addition, the company has acquired the rights to the concessions and all the installations of the Belgo-Argentine Tramways de Buenos Ayres, together with the undertaking, installations, and concession rights of the Buenos Ayres and Belgrano Tramways Company. The Compagnie Generale has ceded to the Anglo-Argentine Company the Belgrano undertaking. The seven tramway undertakings which are sought to be brought under a uniform system of working in Buenos Ayres have a total length of 310 miles, and the duration of the concessions varies from 50 to 91 years.

Metropolitan Amalgamated Railway Carriage and Wagon Company.—The report for the year ended March 31 states that the profit available, after making provision for contingencies and internal reserves, amounts to £339,788, including £93,292 brought forward. For the corresponding period the profit available was £292,972. There has been distributed in interim dividends on preference and ordinary shares the sum of £48,208, leaving a balance of £291,579. The directors propose to carry to reserve fund the sum of £100,000; to pay a dividend at the rate of 12½ per cent. per annum, free of tax, for the half-year ended March 31, on the ordinary shares, making, with the interim dividend already paid, 10 per cent. for the year, absorbing £59,363; and also a bonus on the ordinary shares of 1s. per share, free of tax, absorbing £47,490; leaving £72,135 to carry forward. For the year ended March 31, 1007, the total distribution was 10 per

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cent., £100,000 was then placed to reserve, and £93,293 carried forward. The company last year acquired the business of Docker Brothers, Limited, of Birmingham and London, varnish manufacturers.

British Westinghouse Electric and Manufacturing Company.—The accounts for 1907 show a profit on trading of £92,383, and after providing for depreciation and interest on debentures and loans a sum of £11,341 remains to be carried forward. The directors state that the £250,000 six per cent. prior lien debentures recently issued have been fully subscribed, out of which they propose to pay off the loans from bankers and add a substantial sum to the working capital of the company. An agreement has been arrived at with the American companies whereby the debt to the latter of £186,374 has been liquidated by the transfer of shares in the Traction and Power Securities Company at their par value. Comparative balance sheets for 1906 and 1907 show the effect of the recent reduction of capital of the company. The reduction of the share capital is from £3,250,000 to £1,875,000; the capital expenditure on patents, goodwill, etc., from £794,867 to £375,000; works at Trafford Park from £1,083,021 to £934,935; and machinery, etc., from £911,259 to £775,774. The trading profit of £92,383 for 1907 compares with a loss of £121,305 in 1906.

Burnley Tramways.—The general manager of the Burnley Corporation tramways, Mr. Henry Mozley, has issued his report for the year ended March 31 last. From this it appears that there has been an increase of 388,460 in the number of passengers, and £1,562 in receipts. Parcels receipts show a satisfactory increase. The total receipts amounted to £64,260 (12·827d. per car mile), as compared with £62,698 (12·479d. per car mile) for the previous year, and the expenses have amounted to £39,701 (7·924d. per car mile), as compared with £40,781 (8·118d. per car mile) for the previous year. After paying interest, sinking fund charges, and rents for leased lines, there is a balance of £11,369, which has been carried to the reserve, renewals, and depreciation fund. An interesting item in the working expenses is the cost of rubbing out rail corrugations. Mr. Mozley states that during the year the whole system has been cleared of corrugations at a cost of 2·558d. per yard. Eighty-three per cent. of the rails suffered from corrugation. There are signs, however, that the trouble will recur. The report contains some interesting diagrams of rail sections, showing the wear during the year. These diagrams are taken annually for the purpose of estimating depreciation.

Diesel Engine Company.—The directors' report for the year ended March 31 last, shows that the profit was £20,721, to which has to be added £3,488 brought forward, making a total of £24,209. A dividend of 10 per cent. for the year is proposed, while £7,000 is to go to general reserve, leaving £7,209 to be carried forward. The directors congratulate the shareholders on the prosperous position of the company. The number of orders has been well maintained, and there is a good proportion of repeat orders. The volume of orders carried over on March 31 of this year is much greater than at the corresponding date last year. At the meeting of the company on May 14, at which the report was adopted, Mr. C. C. Ellis, who presided, said that the dividend now recommended compared with 5 per cent. last year. They were placing £7,000 to reserve, against £3,000 a year ago, making £10,000 in all; and the carry-forward was £7,209, against £3,488, the net profit having been £20,721, against £11,212. The cash in hand was £26,360, against £10,661 last year. The orders in hand on March 31 were for 12,799 H.P., compared with 9,442 H.P. on March 31, 1907, and there had since been added about 900 H.P. In the past two years there had been an increase in the profits of nearly £17,000. The directors had given their licensees permission to erect works in Manchester for the manufacture of Diesel engines.

Glasgow's Sinking Fund.—At a meeting of the Council on May 22, Mr. James McFarlane, convener of the Tramways Committee, proposed the adoption of a recommendation as to the sinking fund. He said that when they started the tramway undertaking municipal enterprises of this kind were frowned upon by the authorities in London, and they had to finance themselves as best they could. They were therefore to a considerable extent outside the common law, but during the past three years the Secretary for Scotland had been asking that everything be brought into line, and a special point with him was that while their capital expenditure was fully £3,000,000, their entire borrowings from the Common Good amounted to over £2,000,000, the difference being £876,000. The town clerk, the auditor, and the committee thought it desirable they should carry out the views of the Scottish Office, and increase the sinking fund. It would mean an extra cost on the year's working of £17,500. Several members opposed the recommendation, on the ground that further allowances of the kind were unnecessary and extravagant, and that the accounts for the year just ending should first be considered. The proposal was, however, carried. It was also agreed to proceed with extensions of the tramway system from Maryhill to Springburn, from West Pollokshaws to Rouken Glen, and to Burnside, Rutherglen.

Callender's Cable and Construction Company.—The accounts for the past year show a balance at credit of profit and loss account for the year's working of £60,453, which with the £55,522 brought forward makes a total of £115,976. Of this £11,118 has been appropriated for depreciation. The directors propose to pay a dividend at the rate of 10 per cent. per annum on the ordinary shares and a bonus of 5s. per share, to add £10,000 to suspense account, and to carry forward £45,107. A large firm with which the company has had dealings for some years past has been forced into liquidation. The business is in course of reorganisation, but in order to provide against any possible loss the directors have placed a sum of £10,000 to suspense account. At the meeting of the company on May 21, at which the report was adopted, Mr. T. O. Callender, the managing director, said that the result of the uncertainty of the copper market was the abandonment of all work not of the most pressing description. They knew, however, that large extensions of electric supply mains would be necessary in the more or less near future, and knowing from their intimate touch with the trade that these orders were not going elsewhere, but were merely being "hung up," they felt less worried than they might otherwise do. The company was doing more than its share of the business to be had, more than they could fairly expect to do, and with that for the present they had to be satisfied. He had no fear whatever in regard to the future. On the proposal of a shareholder, the board were authorised, as a record of appreciation of the services of the late Mr. W. O. Callender, the founder of the business and the originator of the process which had brought fortune to the company, to purchase a replica of the existing portrait of Mr. Callender, painted by an Edinburgh artist.

Birmingham Corporation Tramways.—The report for the year ended March 31 last, shows that the total revenue was £289,556, and the working expenses were £168,444. The gross surplus was thus £121,112, and after providing for interest and sinking fund on capital and paying £2,306, the balance of the expenses in connection with the Corporation Bill of 1907, there remains a net profit of £72,037. The Committee propose to place £37,037 to the reserve fund, which will then stand at £64,013, and the balance, £35,000, will, as directed by the Corporation Act, 1903, be carried to the borough fund. The amount proposed to be carried to reserve fund is in excess of the amount based on the calculations made by the Committee, but the charges for interest and sinking fund will be heavier next year, and probably some of the expenses will be increased. The figures of revenue and expenses are arrived at after allowing for various receipts and payments in respect of mutual running powers with companies and other local authorities. The passengers on the city lines only numbered 75,601,195. Per car mile the receipts were 11·42d., and the expenses 6·72d. The number of journeys per head of the population was 136. On the recommendation of the manager, the Committee have adopted a scheme whereby a merit stripe carrying with it 2d. a day additional pay will be given to inspectors, motormen, and conductors who have had three years' continuous satisfactory service, and who, in the case of inspectors and motormen, pass a satisfactory examination as to their knowledge of the mechanical and electrical equipment of the cars and the overhead equipment of the lines. The increase in the number of cars has rendered it necessary to provide additional accommodation at the Miller Street depot. The committee have accepted the tender of A. J. Teall and Company, Limited, at £5,260, for the erection of sheds for 30 additional cars.

National Electric Construction Company.—At the eleventh annual meeting of this company in London, on May 11, Mr. L. B. Schlesinger, who presided, said that the past year had been one of great financial depression, and it had been impossible to raise capital for industrial enterprises, particularly those connected with the electrical industry. The results, however, shown by the accounts for the past year could not be considered unsatisfactory. They had not paid a dividend, but hoped, as stated in the report, to pay an interim dividend later on. It would doubtless be observed that the amount which they carried forward was sufficient to have enabled the board to have declared a dividend of 5 per cent. Referring to various undertakings in which the company were interested, he said that the results so far in regard to the Mexborough and Swinton tramways showed that the investment should be a profitable one. Unfortunately there had been a great deal of trouble with the Dolter surface-contact system, and the directors had decided to have the overhead system installed. Orders for the materials had been placed, and the work would be put in hand at once with the view of having a considerable portion of the system equipped and ready for the Whitsuntide holidays. In regard to the Rhondda tramways, there had been unavoidable delays in the completion. The Taff Vale Railway Company's opposition resulted in two arbitrations and appeals to the Court, which were decided against the railway company with costs. The Rhondda Urban District Council were under obligations to carry out certain road improvements and widenings to enable the tramway lines to be laid. An agreement had been arrived at under which the works should be completed by June 30 next. Owing to financial difficulties the South Wales Power Company were unable to supply current for the tramways, and it therefore became necessary to erect a generating station. The Rhondda Tramways Electric Supply Company had since been formed, and the capital raised. The work was now nearing completion, and it was expected that two sections of the tramways would be opened shortly.

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NEW CONTRACTS AND ORDERS.

Glasgow Tramways Committee have accepted a tender by the Lorain Steel Company for special track-work.

Geo. Robson and Company, of Sheffield, have received an order from Derby Corporation for one of their track grinders.

Mather and Platt have an order from Leek Urban District Council for an engine and dynamo at £2,650.

J. Yates and Company have received an order from Colchester Town Council for tramway wheel tyres.

The British Thomson-Houston Company have an order from Pease and Partners for a 120 H.P. haulage motor and other plant.

The United Electric Car Company are supplying to Preston Town Council five top-deck covers at £110 each.

The British Insulated and Helsby Cables, Limited, have an order from West Bromwich Corporation for an extension of mains at £1,181.

Newcastle Tramways Committee have recommended the acceptance of a tender by the Tudor Company at £3,594 for storage batteries.

Callender's Cable Company have orders from Middlesbrough Town Council for mains at £1,642, and from Malvern Urban District Council for cables.

Birmingham Corporation have specified the use of the Thermit weld for joining the rails on the Bristol Road tramways, which are about to be reconstructed.

The British Thomson-Houston Company have been awarded contracts for a pressure regulator at £302 10s., and a switch panel at £67 for Lancaster Corporation.

Dick, Kerr and Company have an order from Haslingden Corporation for overhead lines with tangential suspension, also for telephones and a tower wagon for the tramways.

Mr. George Law, of Comberton Hill, Kidderminster, has secured the contract for the reconstruction of the tramways in the Bristol Road, Birmingham.

Marylebone Borough Council have accepted tenders by Henley's Telegraph Works Company, St. Helen's Cable Company, and the British Insulated and Helsby Cables for wires, cables, etc.

Southend Town Council have awarded a contract to P. and W. McLellan and Company for 150 tons of rails and fish-plates at £6 4s. 9d. per ton for the rails, and £7 19s. per ton for the fish-plates.

W. Griffiths and Company have obtained a contract from East Ham Town Council for reconstruction of Romford Road tramway track at £15,108. Rails of English manufacture are stipulated for.

Tidswell Lifeguards.—The new cars of the Nottingham Corporation are fitted with this lifeguard, and the Walsall Corporation have also adopted the same in place of those already fixed on their cars.

Harper, Phillips and Company, of Albion Foundry, Eastgate, Grimsby, have received an order for one of their commutator truing machines from the Lanarkshire Tramways Company, Motherwell.

Bolton Tramways Committee have accepted tenders by Edgar Allen and Company for sole-plates, and Hadfield's Steel Foundry Company for points and crossings.

E. Green and Sons have received an order from Bermondsey Borough Council for repairs, etc., to a fuel economiser at the electricity station at £276,10s.

The British Insulated and Helsby Cables are recommended by Aberdeen Electricity Committee as contractors for cables for Cults electric station, at £3,275 15s.

Willans and Robinson, have been awarded a contract by the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board for a 2,000 KW. turbo-alternator at £8,250.

Govan Town Council have, among tenders for stores, accepted those of the British Insulated and Helsby Cables, Limited, for lead-covered and armoured leadless cable, and for joint boxes, and of the Electric Construction Company for 25 to 35 H.P. motors.

Walsall Town Council have accepted tenders by the United Electric Car Company, for four trucks of the Preston compensating type, at £65 each, and by the British Thomson-Houston Company for the electric equipment of four cars at £918.

L. P. Winby and Company have received repeat orders from the Cardiff Corporation Tramways for "Winby" patent anchor chairs, and from the East Ham Corporation Tramways and Bath Electric Tramways for "Winby" patent sole-plates.

London County Council have extended a contract with Hadfield's Steel Foundry Company so as to include special track work for a siding at the Franco-British Exhibition, at £570, and special track work for Forest Hill tramways at £1,786.

Bradford Tramways Committee propose acceptance of tenders by Hadfield's Steel Foundry Company for steel points and crossings at £1,043; Bayliss, Jones, and Bayliss, for steel tie bars, at £119, and steel bolts at £34; and the Forest City Electric Company for copper bonds at £118.

Derby Town Council have accepted tenders by Johnson and Phillips for bitumen cable, and the British Insulated and Helsby Cables for high-tension cable. The Tramways Committee have recommended the acceptance of a tender by Edgar Allen and Company for a new crossing.

Wimbledon Electricity Committee has accepted an offer by James Howden and Company to supply a 1,000 KW. turbo-alternator, switchgear, condenser, piping and valves, for £7,275. The turbine is of Zoelly type, and it will be coupled to a Siemens single-phase generator.

Stoke-on-Trent Corporation have accepted tenders by Willans and Robinson for a steam generating set and condenser at £2,265; by Babcock and Wilcox, for a boiler at £1,410; and by the British Insulated and Helsby Cables for 150 sets of street box fittings at £12 10s., and 150 sets of house service cut-outs at £46 10s.

The Brush Electrical Engineering Company's tender has been accepted by Accrington Tramways Committee for two single-deck cars at £695 each. The Brush Company's tender for a turbo-generator condenser and piping has been accepted by Weymouth Electricity Committee. The amount of the contract is £3,707.

Large Electric Locomotive.—The British Westinghouse Company has received an order for a 300 H.P. electric locomotive from the Newcastle-on-Tyne Electric Supply Company. The machine will be used for hauling coal from the sidings of the North Eastern Railway Company at Dunston to the power-station.

Poplar Borough Council have accepted the following tenders: C. A. Parsons and Company, 1,000 KW. turbine with Bruce Peebles alternator (without rotor), £5,907; Bruce Peebles and Company, two converters of 500 KW., and one of 250 KW., £3,699; British Westinghouse Company, and Johnson and Phillips, sub-station switch gear.

Aberdeen Town Council have by a majority of 17 votes against 11 decided to give a contract for six car top-covers to a local firm whose tender was several pounds per cover higher than the lowest, that of Messrs Milnes, Voss, and Company, of Birkenhead. The Tramways Committee originally recommended the acceptance of the lowest tender, and the Council referred the matter back for further consideration. The Committee did reconsider it, and renewed their recommendation, but the Council on a vote which resulted as above gave the order to the Aberdeen firm.

Messrs. H. Lotery and Company, 4 to 8, St. Mary Street, London, N.E., have secured the contract for the supply of uniform clothing to the British Electric Traction Company, and its associated undertakings, which include about 40 companies. Messrs. Lotery and Company have also secured contracts for clothing from the following: Wakefield and District Light Railway, Pullman Motor 'Bus Company, Blackpool, St. Anne's and Lytham Tramways, Blackpool Corporation Tramways, Brighton Motor Company, Salop and Montgomery Asylum, British South Africa Company, Burton-on-Trent Tramways, Chesterfield Corporation Tramways, Humber Motor Cab Company, Provincial Motor Cab Company, Metropolitan Asylums Board, and Walthamstow Corporation Tramways.

London County Council's Cars.—The London County Council have awarded the following important contracts: Hurst, Nelson, and Company, 175 car bodies, at £414 each, £72,450; British Westinghouse Company, electric equipment and assembly of 175 cars, at £316 10s. each, £55,387 10s.; Heenan and Froude, 175 sets of maximum traction swing bolster trucks, £27,037; Bolckow, Vaughan, and Company, 5,000 tons rails, £34,640; Mountain and Gibson, rotary sand-drying apparatus, £620; Hurst, Nelson, and Company, movable steps for 50 cars, £4 7s. 6d. per set; H. Bessemer and Company, steel tyres for 3,500 driving wheels at 23s. each, and 2,000 trailing wheels at 18s. each, £5,825; Anti-Attrition Metal Company, 200 halves bronze motor axle bearings at 11½d. per lb., 300 bronze journal bearings D.W. at 8s. 3d. each, and 300 bronze journal bearings P.W. at 8s. each.

Walthamstow Urban District Council has accepted the following tenders for the supply of plant for the generating station: Siemens Brothers' Dynamo Works, Limited, two engines and dynamos, £3,595; Babcock and Wilcox, Limited, boiler-house plant, £7,420; Ledward and Beckett, Limited, condensing plant, £2,270 10s.; Alphons Custodis Chimney Construction Company, chimney, £856; Johnson and Phillips, Limited, switchboard, £641 15s.; Paterson Engineering Company, Limited, water softening and purifying plant, £425. Tenders for two sets of engines and dynamos, in addition to the tender of Siemens Brothers' Dynamo Works, Limited, were received from the General Electric Company, Limited, British Thomson-Houston Company, Limited, Electric Construction Company, Limited, and Dick, Kerr and Company, Limited. The Light Railways Committee has decided to accept the tender of Estler Brothers for the supply of fourteen sets of patent block system signals, with lamp attachments, at £19 10s. per set.

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PERSONAL.

Mr. F. W. Purse, Warrington, has been appointed chief electrical engineer to Watford Urban District Council.

Lord Claud Hamilton, chairman of the Great Eastern Railway Company, has been appointed a director of Hadfield's Steel Foundry Company.

Mr. R. Leigh Griffin, who has been engineer aud manager of Mandalay electric tramways for the past five years, has now returned to England.

Mr. W. Pinn, works superintendent to Derby Corporation electricity department, has been granted an increase of salary from £185 to £200 per annum.

Mr. J. E. Teasdel, electrical engineer and manager for Pontypridd Town Council, has been granted an increase of salary from £350 to £400 by two annual increments of £25 each.

Mr. A. W. Clegg, assistant electrical engineer to Accrington Corporation, has been granted an increase of salary from £150 to £165 per annum, with a further rise of £10 after twelve months.

Mr. W. Jackson has been appointed telegraph superintendent of the Buenos Ayres Great Southern Railway. Mr. J. Brayshaw, who has held the office for 23 years, has retired.

Mr. A. A. Watkins, managing engineer for the Sheerness and District Electric Power and Traction Company, has been appointed to a similar position for the Musselburgh Tramways and Electric Light Company.

Mr. H. I. Palmer, chief clerk of the Bradford tramways traffic department, who has been appointed chief assistant to the traffic manager of Liverpool tramways, has been presented with a gold watch and a silver match box, by his colleagues in Bradford.

Mr. John T. Cameron has been appointed borough electrical engineer and deputy tramway manager for Northampton Corporation. Mr. Cameron is a son of Mr. John Cameron, secretary and manager of the Blackpool and Fleetwood Tramroad Company.

Mr. F. O'Hara, resident engineer of the Torquay tramways for the National Electric Construction Company, has been presented (on the occasion of the completion of the construction of the lines) with a gold signet ring and an illuminated address from the staff.

Mr. F. H. Whysall, resident engineer at Bloom Street and Dickinson Street power-stations of Manchester Corporation, has been presented with a silver tea service by the staff of the electricity department on the occasion of his marriage.

Mr. A. Blackmore, of the clerical staff of Bournemouth Corporation tramways, has been presented with a handsome clock from the tramway staff on the occasion of his marriage. Mr. C. Barber, engineer and manager, made the presentation.

Mr. R. N. Torpy, deputy electrical engineer to Wimbledon District Council, has been granted an increase of salary from £200 to £225 per annum. The salary of Mr. R. W. Klitz, the mains superintendent, has been raised from £175 to £200.

Mr. James W. Morgan, pointsman in the employment of Cardiff Corporation tramways was, at a meeting of the Tramways Committee on May 8, presented with the testimonial of the Royal Humane Society for bravery in saving the life of a girl, whom he rescued from the Glamorgan canal.

Mr. James L. Graham, station superintendent at Yoker for the Clyde Valley Electric Power Company, has been presented with an aneroid barometer, a case of drawing instruments, and a slide rule, by members of the staff, on the occasion of his leaving to take up a position in Italy, under the British Westinghouse Company.

Mr. E. C. Amos, consulting engineer, of 22, Walbrook, E.C., has removed his offices to 3, Laurence Pountney Hill, E.C. Mr. Amos has recently been appointed sole British representative for the Swiss Locomotive and Machine Works, at Winterthur, who are manufacturers of locomotives and large power gas and oil engines.

Mr. Edward H. Fleming, who has during the past six and a-half years held the position of rolling stock superintendent of the Newcastle-on-Tyne Corporation Tramways, has resigned his position, and has been appointed London manager of the Empire Lubricating Company, Limited, of Liverpool. Mr. Fleming's London address is 520, 521, and 521a, Salisbury House, London Wall, E.C.

Glasgow Salaries.—At a meeting of Glasgow Town Council on May 7, the recommendations of the Tramways Committee for increasing the salaries of various tramway officials were considered. On the proposal to increase the salary of Mr. Dalrymple, the general manager, by £100, opposition was raised on the somewhat irrelevant ground that commercial and industrial distress prevailed. The increase was carried by the casting vote of the Lord Provost.

TRAMWAY AND LIGHT RAILWAY NOTES.

ABERDEEN.—An interesting report comes from Aberdeen as to the wear of permanent way, and a no less interesting but an unwise action of the local Tramways Committee followed it. The Committee met on May 8, when a report by the borough surveyor was submitted, from which the following is extracted: "I have examined the condition of the section of permanent way between Kittybrewster and Woodside, and find it is in bad repair. This section of the route was laid in 1899, and has thus been in use for over eight years. It was the first section of tramway laid down for the working of electrical cars, and was constructed with 60 ft. rails and ordinary fishplate joints, and was put down before the system of anchoring the tramway rails came into vogue. I find the general tread of the rails all over is worn to the extent of about five-sixteenths of an inch, while at the joints it is worn as much as half an inch. There is still, however, at the same rate of tear and wear, about four years' life in the rails if they were lifted and relaid, and properly anchored both at the joints and along the length of the rail. The joints, which have been more affected by the hammering of the cars than the rest of the rail, will require to be ground with a rail-grinder so as to bring the surfaces at the joints flush with the rest of the rail. The oscillation set up by the movement of the cars has greatly shaken the moist concrete bed, and the rail is now quite loose along its entire length, and it is impossible to keep the paving alongside in repair. I estimate the cost of taking up and relaying the present rails, with sufficient anchorage, between Kittybrewster and Woodside—a distance of 1 mile 352 yards—at £5,365, while if new rails were laid the cost would be £7,865." The Committee thought themselves more competent judges than the surveyor on an engineering question, because after inspecting the track they resolved not to carry out the surveyor's recommendation, but instructed him to execute ordinary repairs, as they thought these would be sufficient. The surveyor will probably take some comfort from the reflection that if the ratepayers suffer from the neglect of his advice, that advice has been fully recorded, and the responsibility now rests on the Committee. This is the only safeguard which engineers have in such cases, and they do well to see that no ground is left for recrimination in the future because of any lack of clearness with which they express their views. It is, however, unfortunate that an untechnical committee should in a matter so essential reject the warning of their professional adviser.

ACCRINGTON.—Arrangements have been made whereby Accrington Corporation will run electric cars through to Haslingden for a year, and will receive 7d. per mile run, Haslingden to pay the inspectors.

BOURNEMOUTH.—The coroner's inquest regarding the death of the seven persons who were killed in the Bournemouth tramway accident on May 1, which had been adjourned after formal evidence, was resumed on May 13 and continued on May 14. Major Pringle, the inspecting officer of the Board of Trade, acted as assessor. Evidence similar to that given at the Board of Trade inquiry which was reported on page 359 of THE TRAMWAY AND RAILWAY WORLD of May 4—was heard, and several witnesses spoke to the defective condition of the rear controller of the car, which, it was alleged, made the magnetic brake inoperative. Mr. C. Barber, the traffic manager, gave the results of experiments with a car similar to the one which was wrecked. Running down a gradient of 1 in 12 at a speed of from 15 to 20 miles an hour, the magnetic brake with all four shoes working stopped the car in 80 ft. 10 ins. With only three shoes working, the stoppage was made in 84 ft. 3 ins., a difference of only 3 ft. 5 ins. The car which ran away had one of the shoes out of action. He thought the hand brake had not been applied till the speed of the car was too great, but he thought the driver did his best. If the driver had known that the magnetic brake was out of order he would probably have applied the hand brake sooner. The witness believed that in such conditions he could have taken the car down safely with the hand brake. Cars ran down the hill with hand brakes only for six months before the magnetic brakes were fitted. The inquest was adjourned.

BRISTOL.—At the inquest on the death of a child who was killed by being run over by a tramway car in Bristol recently, it was stated that no fatal accident had occurred for three years in connection with the Bristol Tramways Company. During that time the cars had run no less than 15,000,000 miles.

CROYDON.—The Town Council have, on the recommendation of the Tramways Committee, agreed to renew and extend the Quin trolley wire cut-out apparatus, which renders a broken wire at once dead. The total cost will be £483. Mr. Goodyer, the manager, pointed out to the Committee that this work would not have been necessary if, in the first instance, regard had been had to the natural increase of the traffic. It was also agreed that, to meet the growth of the traffic, one of the feeder cables should be replaced by a larger one, at a cost of £1,077. In both cases the cost will be charged to the renewals fund.

DUMBARTONSHIRE.—The first section of Dumbartonshire tramways, extending from Dumbarton to Alexandria, was inspected by Colonel Yorke, of the Board of Trade, on May 7, and was thereafter opened for public service. The other sections are well advanced, and

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it is stated that by the end of June they will be completed, so that passengers may be able to travel by tramway from Glasgow to the south end of Loch Lomond.

IPSWICH.—Mr. Frank Ayton, engineer and manager of Ipswich tramways, has reported to the Corporation on the subject of depreciation allowance necessary for renewals. The most important matter is the track, and this he estimates will last for 15 years, four of which are already past. The period of the loan for the track is 40 years. He accordingly urges that the Corporation should have in hand 11 years hence, such a sum as would, with the money obtainable by re-borrowing, amount to £42,500. By that time the amount of loan repaid will be £10,408, so that there remains to be provided from revenue £32,092. The Town Council have adopted the report.

LONDON.—At North London Police Court on May 2, Walter Francis, a tramway car driver in the employment of London County Council, was summoned on a charge of recklessly driving an electric car on January 1 last. The car collided with a brougham and did some damage, and police evidence was to the effect that the car was travelling at from 14 to 16 miles an hour. It was stated, on behalf of the County Council, that the Board of Trade regulations allowed electric cars to travel in Kingsland Road at 16 miles an hour. The Magistrate (Mr. Fordham) said that the Board of Trade must be extremely ignorant of the conditions in Kingsland Road. The sooner the President or some responsible official of the Board paid a visit to the district the better it would be for the public who had to use the road. For the defence it was contended that this was an ordinary accident for which the defendant could not be made liable in that court. The defendant himself said that he was not travelling at more than eight miles an hour. Since the time of the accident he had been transferred to a horse car because he could not pass the medical examination for electric car drivers. The Magistrate said he thought that the statement that the Board of Trade had sanctioned 16 miles an hour in Kingsland Road must be a mistake. To his mind no car should travel at a greater speed than 10 miles in a thoroughfare like that. A greater speed he regarded as a danger to the public. He was satisfied that the defendant had exceeded that speed, and he fined him 40s., with 2s. costs. He felt thankful that the defendant was no longer a motor-driver. These electric cars were very convenient, but extremely dangerous.

MANCHESTER.—For some time past there has been an impression locally that unjustifiable attempts have been made in the Courts to fix liability on Manchester Corporation for tramcar accidents in which the Corporation were not to blame. The Corporation, feeling aggrieved, at length made an appeal in a case in which Mrs. E. Wallis was, at Salford County Court, awarded £42 damages against Manchester Corporation in respect of a broken wrist sustained in an accident. The plaintiff's contention was that she was jerked off a car platform by a sudden movement of the car. The Corporation's plea was that she got on to the car though she was told it was full, that the conductor rang the bell to stop the car, and that before it stopped she stepped off and sustained the injury. Justices Darling and Phillimore in the King's Bench Division, on March 16, held that the evidence for the defendants outweighed that for the plaintiff many times over, and they allowed the appeal and ordered a new trial.

WEST HAM.—Since East Ham Town Council resolved to purchase and electrify the North Metropolitan Tramway Company's horse line in the borough, arrangements are being pushed forward for through running of electric cars in West Ham, East Ham, and Ilford. West Ham Tramways Committee have approved of the appointment of Mr. J. B. Hamilton, general manager of Leeds tramways, to act as arbitrator for the purpose of settling the terms of the through running.

WIMBLEDON.—A report has been presented to Wimbledon Town Council on the benefits in the shape of street widening, etc., which have accrued to the borough in connection with the construction of the lines of the London United Tramways Company, Limited. From this it appears that the company paid the Council £5,000 to be relieved of their liability to move manholes and sewers from under the tramway. Further, the company pay in rent £364 per annum in respect of the lines in Wimbledon, which are 3·64 miles long. The street widenings carried out free of cost to the Corporation have added 15,074 square yards to the area of the streets, while the Council have themselves executed some minor widenings. The total cost to the Council of improvements was small, but no statement is made as to the large amount which the tramway company expended as the price of being allowed to construct their lines.

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Utilizes Waste Heat Efficiently.

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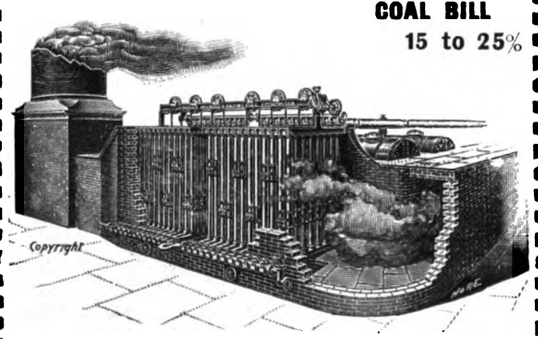

Patentees and Sole Makers—

E. GREEN & SON, LD., Wakefield, Manchester, London, and Glasgow.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS.

Applications for Letters Patent have been filed:

9,099 Trolley for electric railways and tramways—A. Wermann.
9,124 Railway and tramway points, switches and signals—A. E Dodwell.
9,203 Signalling apparatus for electric railways and tramways—P. J. Pringle and G. W. Green.
9,231 Electrical railway signalling systems—W. H. Lewers.
9,232 Electrical railway signalling systems—W. H. Lewers.
9,290 Railway frogs or crossings—P. M. Justice.
9,360 Trolley head for electric tramcars—J. O. Millard.
9,386 Apparatus for preventing accidents in connection with tramcars—T. Yates
9,403 Brakes for tramways and railways—P. J. Pringle.
9,569 Electric wire poles or masts—J. Jaeger.
9,571 Electric locomotive signalling device with automatic control of steam whistle and continuous brakes—J. Kordin.
9,727 Rail in two or more sections for tramways and light railways—T. H. Smaldon.
9,775 Trucks for railway and tramway vehicles—The Magnolia Anti-Friction Metal Company of Great Britain, Limited, and E. Peckham.
9,821 Side guards for tramcars—H. D. Whiteley.
9,865 Switch plate for the aerial wires of electric tramways—A. G. Boon.
9,962 Tram and other rails.—J. G. Pegley, sen., J. G. Pegley, jun., and W. J. Griffin.
9,991 Lifeguards for tramcars—J. Bowring.
10,032 Bogies for railway carriages—F. L. Lane and the Leeds Forge Company, Limited.
10,061 Sand hopper for tramway cars and motor wagons—G. Wharam.
10,106 Self-adjusting side guard for bogie tramcars—W. Philipson, T. W. H. Philipson, and P. C. Philipson.
10,108 Lifeguards for motor cars and tramcars—H. Smith and G. S. Waterfall.
10,109 Emergency brake systems—W. H. Turner.
10,118 Electrical railways and tramways—C. von Gizinsky, W. McClure and E. Wiesner.
10,168 Trolley heads for electrically-propelled vehicles—H. Simpson.
10,227 Traction vehicles—R. E. Zager.
10,273 Sanding apparatus for trolley cars—C. Snyder.
10,327 Track brake shoes—W. Love.
10,337 Car replacers—H. M. Cawood.
10,349 Means for arresting the motion of tramcars—J. R. Brayshaw.

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10,351 Magnetic or rheostatic brakes—M. Cummins.
10,460 Street or road railway points—H. Hocking.
10,538 Device for stopping a runaway tram or motor 'bus—H. Oxley.
10,546 Lifeguards, snow shifters for tramcars, locomotives, and motor cars—S. Baxter.
10,552 Controlling of trolley poles of electric cars—S. Henshaw and J. Swindells.
10,723 Surface contact for electrical traction—J. W. Fillis.
10,784 Controlling electric motors for tramcars—The Johnson-Lundell Electric Traction Company, Limited, and W. A. Price.
10,857 Passenger cars—J. H. Herbst, H. Fass, and M. Shank.
10,956 Sand-box operating mechanism for railway and tramway vehicles—P. McCullough and W. Vaux.
11,160 Automatic brakes for power-driven trains.—C. G. Conradi.
11,175 Electro-magnetic switch for tramway lines—A. Köhler and F. Köhler.
11,210 Apparatus to prevent skidding or side-slip of motor omnibuses J. Iron.

SPECIFICATIONS PUBLISHED.

1906.

21,347 Electric signalling apparatus—Felten and Guilleaume Lahmeyerwerke Akt.-Ges.

1907.

10,998 Guards or frames for protecting posts, pillars, and standards Hattersley and Heath.
14,287 Ventilation of power-driven mechanism of self propelled vehicles—British Thomson-Houston Company and Hopps.
20,400 Railway points.—Bruce.
25,076 Couplings for railway and tramway trains—Gellhorn.
25,596 Couplings for railway and tramway vehicles—Wren.
27,658 Mounting of railway and tramway vehicles on their wheels—De Bange.
8,623A Propulsion of electrically-driven trains—Stone and Mignotti.
17,745 Drainage pipes for tram rails—Horsfield and Hemming.
18,515 Protective device for electric transmission systems—British Thomson-Houston Company (*General Electric Company*)
19,138 Railway rail joints—Reel.
22,609 Trolley mechanism for electrically-propelled cars—Craig.
25,299 Brake applying and warning or indicating devices for railway trains—De Braam.
25,391 Rail bond for rail joint circuits—Karns.
26,039 Railway rail joints—Bastel.
9,479 Passenger fare indicators—Richert.
22,442 Indicators for motor cars—Reason.
26,640 Railways rails and rail joints—Watkinson.
9,390 Electric-vehicle or locomotive brakes—Simpson.
10,636 Electric traction installations using contact boxes—Black and Black.
25,961 Automatic sand-valve opener for tramcars and electrically-driven vehicles—Hosken.

1908.

3,475 Metallic railway tie—Bowne.
257 Track rail-grinding apparatus—Kidd and Ellis.
1,698 Guards for railway vehicles—Sanford.
3,693 Motor road vehicles and trains—Soc. Ed. Surcouf et Cie.

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Made to Order on Reasonable Terms.
In use on the Colchester Corporation and the West Ham Corporation Tramways.
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OLD STEEL TRAMWAY RAILS.
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WARNER ENGINEERING COMPANY, LIMITED,
DARTMOUTH STREET, S.W.

TRAFFIC RETURNS.

TRAMWAYS AND OMNIBUSES.	1907. WEEKS ENDING. May 4.	May 11.	May 18.	May 25.	1908. WEEKS ENDING. May 2.	May 9.	May 16.	May 23.	AGGREGATE. Wks.	1908.	Increase or Decrease.
	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	1,252	1,384	1,303	1,305	1,208	1,340	1,342	1,390	51	68,742	− 1,231
Ayr Corporation	241	222	235	286	262	232	233	294	1	347	− 58
Bath Electric	703	713	790	839	624	742	729	745	20	12,545	− 1,288
Belfast City	3,463	3,704	3,612	3,868	3,539	3,643	3,595	3,862	8	27,788	+ 531
Birmingham Corporation	5,942	6,190	6,182	6,976	6,248	6,256	6,364	6,445	8	48,522	+ 1,189
Blackburn Corporation	961	1,052	1,087	1,348	950	1,050	1,169	1,123	8	9,255	+ 97
Blackpool and Fleetwood	387	304	358	1,482	303	354	350	355	21	5,998	− 1,367
Blackpool Corporation	486	511	532	1,757	480	531	549	547	7	5,447	− 126
Bolton Corporation	2,212	2,245	2,147	2,993	2,287	2,318	2,354	2,344	8	18,508	+ 552
Bournemouth Corporation	1,511	1,654	1,533	2,084	1,526	1,566	1,426	1,472	7	11,736	− 1,115
Bradford Corporation	4,426	4,669	4,547	5,464	4,478	4,487	4,698	4,839	8	35,701	+ 1,496
Brighton Corporation	775	911	878	1,217	825	775	775	837	8	6,282	− 407
Bristol	4,736	4,943	5,152	6,472	4,763	4,910	4,799	4,839	21	97,731	− 4,393
British Elec. Trac. Co's. Undertakings											
Airdrie	218	221	234	230	219	212	225	227	20	4,485	+ 49
Barnsley	159	164	171	211	147	168	179	182	20	3,440	+ 183
Barrow	232	234	231	326	213	225	226	213	20	4,486	− 80
Birmingham and Mid. Joint Com.											
Birmingham and Midland	758	810	794	...	747	776	808	...	19	15,310	+ 772
City of Birmingham	2,702	2,911	2,931	3,248	2,765	2,719	2,806	2,881	20	54,998	− 75
Dudley-Stourbridge	796	835	830	1,459	717	749	776	820	20	15,210	− 1,761
South Staffordshire	845	883	880	1,254	784	824	847	858	20	17,340	− 636
Wolverhampton District	436	473	463	832	429	454	431	435	20	8,868	− 516
Cavehill	59	76	87	106	70	77	90	108	20	1,560	+ 93
Devonport	435	432	446	522	446	480	449	436	20	8,733	− 138
Gateshead	982	1,015	1,026	1,078	898	967	983	968	20	19,914	+ 120
Gravesend and Northfleet	218	237	245	326	185	196	204	211	20	3,883	− 702
Greenock-Port Glasgow	667	655	698	742	513	499	520	563	20	9,870	− 2,765
Hartlepool	258	260	283	463	181	194	210	225	20	4,260	—
Jarrow	120	132	134	167	82	94	106	110	20	1,989	− 337
Kidderminster	93	109	100	228	84	89	93	104	20	1,802	− 279
Leamington	130	143	143	259	143	150	142	152	20	2,811	− 65
Merthyr	198	216	206	290	199	202	195	212	20	4,099	− 50
Metropolitan Electric	4,170	4,576	4,993	5,612	5,050	5,466	5,823	6,315	20	102,319	+ 18,218
Middleton	307	345	368	432	292	347	370	379	20	6,621	+ 27
Oldham-Ashton	569	603	610	785	525	587	602	607	20	11,751	− 82
Peterborough	108	126	136	161	109	111	125	127	20	2,221	− 86
Potteries	1,851	1,825	1,861	2,221	1,669	1,782	1,796	1,780	20	36,731	− 7

(Continued on page 478)

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TRAFFIC RETURNS—*continued.*

TRAMWAYS AND OMNIBUSES.	1907. WEEKS ENDING. May 4.	May 11.	May. 18.	May 25.	1908. WEEKS ENDING. May 2.	May 9.	May 16.	May 23.	Wks.	AGGREGATE. 1908.	Increase or Decrease.
British Elec. Trac. Cos.—*continued.*	£	£	£	£	£	£	£	£		£	£
Rothesay	85	95	116	226	117	100	101	204	20	1,729	- 157
Sheerness	54	55	56	65	53	53	54	57	20	1,005	- 23
South Metropolitan	657	752	803	948	725	761	791	898	20	14,115	- 337
Southport	236	257	270	497	229	246	261	265	20	4,495	- 589
Swansea	807	823	840	1,118	871	923	880	871	20	17,470	+ 975
Taunton	43	42	39	54	38	40	39	37	20	775	- 42
Tynemouth	168	176	211	333	146	153	181	197	20	3,087	- 497
Weston-super-Mare	60	63	80	307	73	84	85	80	20	894	- 325
Worcester	258	277	264	388	259	275	266	278	20	4,974	- 160
Wrexham and District	94	93	97	125	95	94	102	97	20	1,935	- 25
Yorks. (Woollen) District	935	970	1,002	1,163	817	915	937	913	20	17,881	- 1,006
Burnley Corporation	1,160	1,257	1,257	1,369	1,200	1,201	1,243	1,263	21	30,752	+ 252
Burton-on-Trent Corporation	274	283	283	328	278	266	267	256	8	2,031	- 225
Bury Corporation	987	996	999	1,513	1,112	1,221	1,200	1,160	7½	9,280	+ 977
Cardiff Corporation	1,945	1,973	1,999	2,559	2,113	2,096	2,059	2,076	8	15,988	- 480
Carlisle, City of	172	178	182	196	154	174	165	162	21	3,244	- 11
Chatham and District	650	700	740	853	719	808	794	860	20	13,508	- 183
Chesterfield Corporation	196	217	200	273	199	213	225	229	7	1,628	+ 4
Colne and Trawden	193	230	219	280	196	205	213	222	21	4,043	- 185
Cork Electric	449	449	460	493	435	486	443	473	20	8,294	- 481
Croydon Corporation	1,333	1,432	1,495	1,655	1,323	1,395	1,426	1,575	8	10,421	- 730
Darlington Corporation	207	221	216	226	181	189	210	191	8	1,556	- 125
Derby Corporation	720	778	826	1,009	812	790	867	861	7½	6,517	+ 233
Dover Corporation	192	229	202	280	185	179	184	188	8	1,432	- 326
Dublin and Lucan	99	107	110	170	113	123	120	132	21	2,169	+ 46
Dublin United	5,162	6,000	5,609	6,768	5,151	5,363	5,164	5,474	21	99,686	- 1,598
Dundee City	1,070	1,105	1,120	1,100	1,174	1,168	1,236	1,202	52	59,415	+ 2,614
East Ham Corporation	876	924	931	1,082	794	799	834	879	8	6,997	- 616
Exeter Corporation	278	296	298	404	292	301	287	302	8	2,211	- 53
Falkirk and District	309	274	273	285	288	264	267	263	8	2,181	- 83
Glasgow Corporation	17,269	18,402	18,163	18,192	17,135	17,463	17,680	18,217	51	886,931	+ 14,066
Glossop (Urban Elec. Supply Co.)	136	136	135	147	126	136	135	126	21	2,529	- 159
Hastings and District	909	1,047	1,336	1,032	952	881	947	973	21	17,488	- 951
Huddersfield Corporation	1,448	1,585	1,569	1,879	1,506	1,494	1,586	1,591	8	12,696	- 294
Hull Corporation	2,394	2,403	2,409	2,575	2,363	2,402	2,418	2,370	8	18,480	- 319
Ilford Corporation	449	500	433	583	410	414	494	458	8	3,275	- 418
Ilkeston Corporation	121	137	151	183	120	141	153	157	7	1,116	- 35
Ipswich Corporation	349	391	389	475	339	351	374	389	8	2,731	- 201
Isle of Thanet	342	427	454	763	398	398	409	444	21	5,994	- 911
Keighley Corporation	...	166	160	...	...	156	165	...	46	7,223	+ 315
Kilmarnock Corporation	144	151	199	166	144	150	185	161	1	213	- 60
Lanarkshire	1,103	1,203	1,271	1,240	1,272	1,235	1,318	1,402	20	25,551	+ 3,209
Lancashire United	1,080	1,226	1,220	1,426	1,111	1,247	1,342	1,367	20	24,722	+ 1,160
Leeds City	6,293	6,560	6,605	7,242	6,243	6,226	6,514	6,609	8	48,904	+ 822
Leicester Corporation	2,139	2,398	2,364	2,605	2,179	2,164	2,323	2,317	21	44,192	- 767
Leith Corporation	478	527	495	506	503	504	518	525	1½	679	- 127
Leyton U. D. Council	945	1,083	1,084	1,440	910	916	997	1,170	8	7,388	- 721
Liverpool Corporation	10,801	11,014	10,897	11,562	10,872	10,714	10,788	10,976	21	216,119	- 2,699
London County Council	29,745	32,116	31,764	...	32,807	33,291	34,285	...	7	214,626	+ 18,478
London General Omnibus	20,944	23,012	22,224	22,015	21,780	22,285	22,529	24,592	21	393,826	- 16,234
London Road Car	8,112	8,896	8,685	8,769	8,263	8,619	8,605	9,666	21	146,622	- 5,809
London United	5,913	6,844	6,895	9,135	6,220	6,365	6,852	7,691	21	116,869	- 4,131
Lowestoft Corporation	140	156	161	219	159	160	157	173	34	5,316	+ 39
Maidstone Corporation	...	...	...	...	174	184	183	196	8	1,394	—
Manchester Corporation	13,620	14,629	14,956	17,869	14,407	14,469	15,177	15,549	8	113,696	+ 4,837
Nelson Corporation	132	150	141	152	140	136	139	140	7½	1,094	- 149
Newcastle-on-Tyne Corporation	4,035	4,120	4,051	4,205	3,500	3,805	3,683	3,643	8	28,922	+ 3,435
Newport (Mon.) Corporation	604	633	630	847	646	628	617	635	8	5,129	- 208
New St. Helens and District	582	620	615	964	563	677	700	733	47	32,343	+ 697
Northampton Corporation	389	449	437	558	387	475	439	448	7½	3,224	— 187
Oldham Corporation	1,871	1,959	1,859	1,968	1,894	1,949	1,989	2,000	8	17,269	- 168
Portsmouth Corporation	1,778	1,865	1,761	2,331	1,849	1,880	1,827	1,906	8	13,988	- 1,112
Preston Corporation	683	728	715	1,021	636	729	749	725	21	14,316	- 467
Provincial	1,518	1,600	1,690	2,375	1,579	1,607	1,647	1,742	34	50,650	+ 48
Reading Corporation	585	598	632	698	563	642	607	623	7½	4,375	- 147
Rochdale Corporation	994	1,122	1,061	1,357	1,075	1,101	1,143	1,161	8	8,957	+ 416
Rossendale Valley	210	200	205	235	172	191	194	191	21	3,862	- 154
Rotherham Corporation	549	577	577	785	528	567	617	619	7½	4,402	- 173
Salford Corporation	4,494	4,582	4,560	6,261	4,560	4,639	4,656	4,619	8	36,306	- 2,186
Sheffield Corporation	5,454	5,699	5,452	5,961	5,396	5,740	5,680	5,694	8½	47,593	- 1,753
Southampton Corporation	898	932	971	1,104	858	1,079	1,026	1,037	7	7,092	+ 222
Southend-on-Sea Corporation	277	325	346	472	311	342	347	372	8	2,487	- 74
South Shields Corporation	547	573	575	653	496	532	526	528	7½	4,017	- 307
Sunderland Corporation	1,385	1,358	1,364	1,473	1,050	1,126	1,151	1,111	8	10,936	- 2,299
Sunderland District	432	442	623	400	408	440	459	471	—	—	—
Swindon Corporation	153	158	179	179	142	148	146	140	8	1,167	- 200
Tyneside Tramways and Tramroads	408	423	458	504	295	326	380	388	21	7,387	- 1,196
Wallasey U. D. Council	761	778	790	994	844	828	842	886	7½	6,444	+ 7
Walsall Corporation	442	483	497	674	504	530	539	541	21	10,793	+ 1,000
Walthamstow Corporation	514	615	626	813	575	565	640	720	8	4,619	+ 142
Warrington Corporation	489	379	387	387	466	380	375	375	7	2,758	+ 57
West Ham Corporation	2,178	2,298	2,514	2,597	1,924	2,136	2,187	2,262	8	17,269	- 1,976
Wigan Corporation	1,171	1,206	1,248	1,500	1,169	1,270	1,339	1,318	7	9,803	- 634
Wolverhampton Corporation	777	839	841	1,362	826	895	785	804	7	5,996	- 565
Yorkshire (West Riding)	1,110	1,288	1,131	1,577	1,159	1,374	1,296	1,179	21	23,539	+ 293
FOREIGN TRAMWAYS.											
Anglo-Argentine	17,395	17,447	17,519	16,662	19,664	19,438	18,483	19,508	21	390,326	+ 43,073
Auckland ...(month)	10,982	...	...	...	11,783	...	...	...	17	48,883	+ 5,749
Bombay Rs.	27,422	28,260	...	...	35,990	37,634	...	...	18	655,713	+125,303
Brisbane ...(month)	12,659	...	...	...	14,460	...	...	...	17	56,680	+ 7,357
British Columbia (month) $	117,402	...	...	...	153,725	...	...	...	43	1,643,985	+453,670
Buenos Ayres and Belgrano	3,718	3,985	3,960	3,824	3,667	4,044	3,696	4,203	21	80,107	+ 671
B. Ayres Grand Nat. & New (Joint)	6,892	7,247	7,263	6,857	7,779	8,006	7,438	8,058	20	155,711	+ 18,835
Calcutta Rs.	45,376	45,174	44,662	44,396	45,746	45,310	45,826	44,220	20	966,218	- 33,893
Havana $	33,475	32,490	...	...	34,427	37,407	...	...	—	-	-
Kalgoorlie ...(month)	3,895	...	...	...	3,721	...	...	...	17	15,040	- 568
Lisbon M	...	...	...	...	115,614	...	...	...	17	462,754	-
Madras Rs.	17,315	(2 weeks)	17,580	(2 weeks)	18,651	(2 weeks)	19,376	(2 weeks)	17	173,252	+ 17,782
Mexico $	384,200	...	...	...	433,433	...	...	...	17	1,703,579	+195,897
Montevideo ...(month)	16,145	...	...	...	17,736	...	...	...	26	126,398	+ 19,557
Perth (W.A.)	1,426	1,359	1,364	1,292	1,381	1,379	1,363	1,407	21	29,673	- 852
Rio de Janerio ...(month)	395,908	...	...	...	447,588	...	...	...	17	447,588	+ 51,680
Sao Paulo (month) $	170,334	...	...	...	196,223	...	...	...	17	773,942	+ 73,083
Singapore $	9,794	9,615	9,365	9,740	8,585	9,545	10,129	8,902	34	315,267	+ 2,890
ELECTRIC RAILWAYS.											
Baker Street and Waterloo	2,500	2,390	2,360	2,580	3,070	3,040	3,120	2,775	21	64,455	+ 14,804
Central London	6,089	5,924	5,828	5,473	5,786	5,999	6,630	6,518	21	126,811	- 1,954
Charing X Euston & Hampstead	...	...	...	...	3,230	3,240	3,360	3,290	21	67,185	—
City and South London	2,905	2,694	3,156	3,057	3,121	3,000	2,964	2,804	21	68,356	+ 6,302
Great Northern and City	1,835	1,729	1,740	1,663	1,644	1,593	1,576	1,551	21	36,192	- 2,315
Gt. North'rn, Piccadilly, & Brompton	4,205	4,050	4,080	4,300	5,405	5,565	5,565	5,260	21	113,720	+ 32,701
Liverpool Overhead	1,525	1,475	1,509	1,754	1,446	1,399	1,423	1,475	21	29,236	- 750
Mersey	1,856	1,898	1,922	1,980	1,899	1,837	1,956	1,855	21	40,280	+ 1,499
Metropolitan	15,613	15,353	15,104	16,086	15,668	15,457	15,407	15,491	21	320,506	+ 2,343
Metropolitan District	8,125	7,759	7,966	8,129	8,632	8,970	9,005	8,885	21	186,424	+ 20,271

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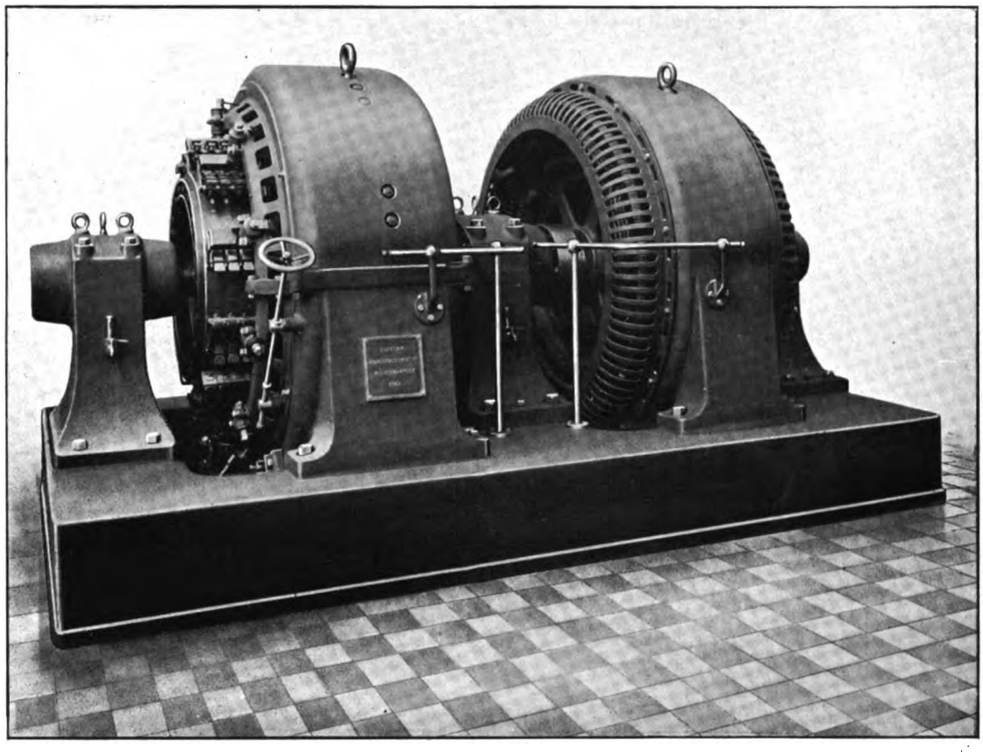
MOTOR-GENERATORS.

E. C. C.



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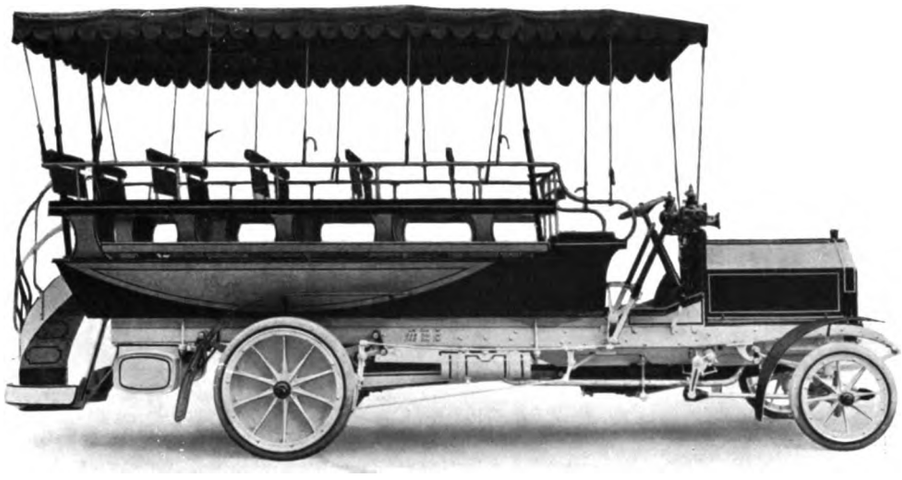

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AN OPINION "AFTER 16 MONTHS' CONTINUOUS RUNNING."

SILSDEN MOTOR OMNIBUS CO., LTD.,
nr. Keighley, Yorks., Nov. 13, 1907.

Dear Sirs,

With reference to the Motor Omnibus which you supplied to us in July, 1906, after 16 months' continuous running we are pleased to report to you that the good opinion we at first formed of your 'Bus has been more than justified by results, **and we congratulate ourselves in owning what we consider to be the best 'Bus on the market.** In consumption of Petrol and Oil she is remarkably economical. As to repairs your ledger will disclose that **our purchase of parts, &c., from you during the last six months have not exceeded £5,** which fact speaks volumes for the excellent workmanship of your Chassis. She requires a minimum amount of attention to keep her at concert pitch, and we can always depend on her carrying her complement of passengers (40) with ease up the long and steep gradients so numerous in this locality. We have nothing but unstinted praise for the manner in which your 'Bus has done its work on our country roads since July, 1906.—Yours faithfully,

p. pro **Silsden Motor Omnibus Co., Ltd.**
(Signed) M. P. CRYER, Secretary.

RYKNIELD MOTOR CO., LTD.,

BURTON-ON-TRENT.

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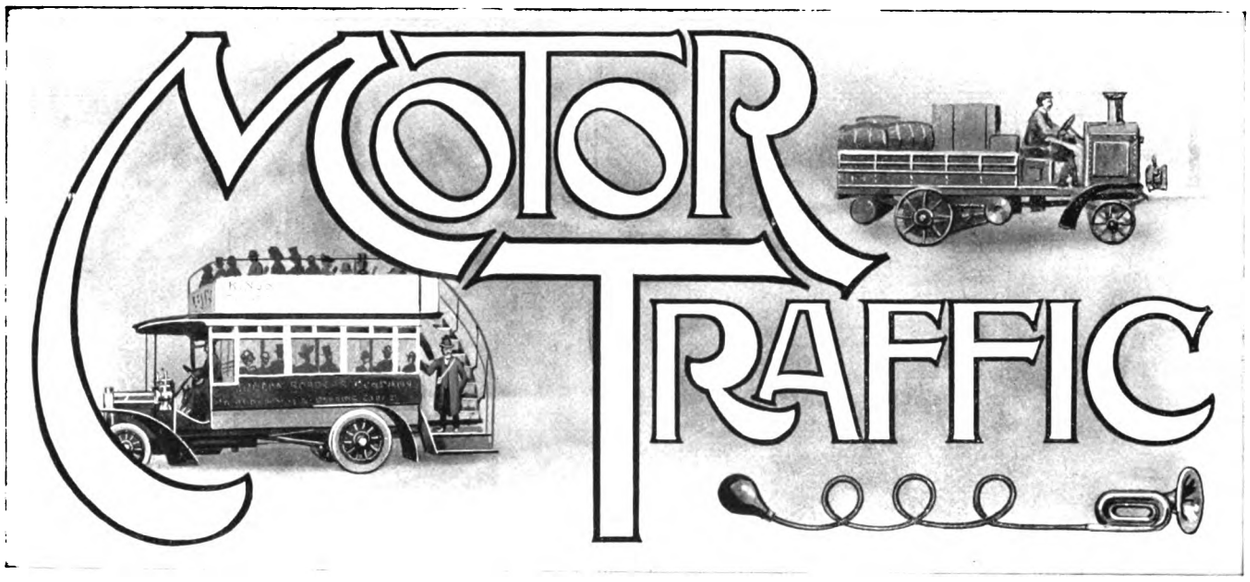

In consequence of the present position of the motor omnibus business in London, manufacturers are finding considerable difficulty in bringing to a satisfactory conclusion business negotiations which have been in progress for a more or less lengthy period with suburban and provincial authorities. On the face of it, this would appear to be a perfectly reasonable result from the comparative failure of the London motor vehicles, but on looking further into the matter, we are the strongly of opinion that the conditions under which motor omnibuses would be run outside London are so different from those which have prevailed within the Metropolitan area as to make the comparison of little value. As we have already pointed out, the investor was led to expect very much more than it was possible to obtain from this class of traffic, even under the best of management, and when we remember that inexperienced and incompetent men succeeded in obtaining important positions with some of the companies running motor 'buses, the wonder is that the net result has not been even more disastrous to the shareholders of these concerns. Fortunately a very great improvement has taken place with regard to the higher officials who are responsible for London's motor 'bus service, but we are of the opinion that there is room for considerable improvement in the methods adopted by many of the drivers of both the petrol and steam vehicles. Not only is the life of tyres considerably shortened by the careless handling of the 'bus, but the effect on the machinery is such that friction has frequently been caused between the manufacturer and the companies' engineers on account of the high maintenance costs, the latter complaining of faulty material, etc., when the true cause of the trouble has been due to unfair usage. An example of careless driving was recently brought to our notice on one of the Metropolitan steam omnibuses running in Piccadilly. The driver had evidently approached the rise leading towards the Circus with the steam pressure too low to take the hill; he had, therefore, to "flog" the donkey engine, the outward signs of which were a cloud of smoke and a bad smell.

The small proprietor who contemplates the inauguration of a motor 'bus service in the provinces, or some urban or rural district, can easily profit by all the mistakes that have been made by the London companies. In the first place it will be comparatively easy for him to obtain reliable information with regard to the several types of 'buses which are now giving satisfaction from the mechanical point of view. Then he should have no difficulty in obtaining the services of a good practical man who would keep the vehicles on the road, and last, but not least, he can select non-competitive routes which would enable him to arrange his service and fares in a manner that would ensure a fair return on his capital expenditure. With regard to the development of traffic, the experience gained in the early days of tramways is being repeated. Wherever a regular service can be depended upon between any two or more districts, additional movement is encouraged and an increasing business built up, until in many instances the result has surprised the promoters. Bearing in mind each of these points, we think that instead of the London position retarding the advent of motor 'buses in the country generally, advantage should be taken of this experience, and by avoiding the mistakes of finance and management now disclosed, services that should not only give facilities for rapid transit in districts now ill-served, but also prove satisfactory to the promoters, can be built up.

The storage battery type of omnibus is still running in London, and it is gradually increasing in numbers. We have on former occasions expressed doubt as to the success of the undertaking, but so long as the makers of the batteries are content to maintain them at the present contract rate the omnibus company ought to be able to make some profit. Some engineers not associated with the accumulator industry are now inclined to admit that possibly there may be something in the storage battery omnibus from the financial point of view, provided that it receives regular skilled attention and runs on level roads. This is as regards the lead accumulator. In this issue, however, we publish an article calling attention to what is being done on the Continent with the nickel and iron battery. This is the type on which Edison in America has for several years been working, but with no very tangible results so far as commercial use is concerned. The German experiments, however, look very promising, and it is quite possible that before long we may have a nickel and iron (or steel) battery which will be much more durable and economical than the lead one, and comparable in economy with the petrol engine. As soon as that stage is reached the latter will disappear, so far as motor omnibuses are concerned, unless it survives in combination with electric transmission. It is quite

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clear that, given equal economy, the accumulator vehicle will be preferred for many purposes to all others.

The agitation concerning the great increase in the cost of road maintenance caused both by fast pleasure cars and by slower and heavier motor vehicles continues to grow in volume. County councils and ratepayers, indeed, have a genuine and growing grievance. In many quarters it is maintained that motor traffic has no sensible injurious effect on paved streets, and that the trouble is confined to macadam roads. This is by no means the universal view, however, and the metropolitan tramway managers are agitating over damage done to their track paving by motor 'buses and other heavy vehicles. The tramway undertaking which does not wear or damage the paving at all has to pay for the damage done by other vehicles. It is quite reasonable to suppose that any heavy vehicle, even if provided with india-rubber tyres, must do damage by the process of crushing and by the heavy blows delivered at every inequality of the street surface. There can be hardly any doubt that sooner or later some means will have to be adopted for securing some contribution to road maintenance from the owners of motor vehicles above a certain weight. In this we cannot see any injustice.

Bearing on the same subject was the recent agitation among motorists in favour of the proceeds of any added taxation on motor cars being used for road maintenance. It was assumed as highly probable that such additional taxation would this year be imposed by the Chancellor of the Exchequer. Accordingly, large numbers of local authorities were induced to declare in favour of a central fund for road maintenance into which the tax money should be paid. The storm has blown over in the meantime, as no additional taxation has been proposed. It is quite possible, however, that the delay only means that next year there may be a more thorough-going scheme of taxation, especially on pleasure cars. If this comes about, the impost should certainly be graduated, so that the large, costly, and fast cars should pay more than others. Industrial vehicles ought to pay least of all; they cannot stand a heavy tax.

The price of india-rubber tyres is still going down, and a continuation of the fall will soon be of marked benefit to the motor omnibus industry. There may be some fluctuations during the next year or two, but thereafter will come a great and permanent decrease, as the plantations of the india-rubber producing companies become more and more productive. Similar prospects cannot be held out as regards the price of petrol, but a good substitute is being found in a product—it is going by various names—obtained in the distillation of coal, and beyond that are the inexhaustible supplies of alcohol which will be obtainable as soon as legislative restrictions are removed.

THE ELECTROBUS.—In connection with the visit of the French President in the end of May, the London Electrobus Company had a number of their vehicles chartered by the Admiralty to take 264 French sailors for a day's outing in the Metropolis. This was the first occasion on which public licensed vehicles were admitted to the Royal parks in London.

DEVELOPMENTS IN ELECTRIC ACCUMULATORS FOR MOTOR CARS.

Regarded by everyone as the ideal system of working motor cars or vehicles of all types, the storage battery method has so far not made its title thoroughly clear in all essentials; the doubt as to working costs inclusive of depreciation, the objections of great weight and noxious acid fumes, have prevented the lead accumulator from being regarded as perfect for the purpose.

Great improvements have doubtless been made of late years in the manufacture of cells; and the quiet and regular running of the London Electrobus vehicles has done much to rehabilitate the good opinion in the public mind that many battery tramcar failures had shattered. Still more is required, however, to show such an advance that the petrol 'bus, or cab, or van shall be faced from this direction with a serious competitor in regard not only to quietness and ease of running, but also on financial grounds, including such points as economy of first cost, running chages, renewals, maintenance, and durability.

Perfection in all or most of these qualities has been boasted for many years in the popular press on behalf of the so-called Edison battery, the announcement of final touches to ensure complete satisfaction appearing regularly every other year or so.

Of course, the electric couple between nickel and iron in an alkaline solution as employed by Edison is well-known, and more than one inventor has already worked on these lines, only to find some insuperable difficulties in regard to strong local action, which at once reduces the effective cell pressure to an impossible degree for practical working.

Much of the credit properly due to those who find a solution to this problem can now be given to practical experimenters like Messrs. Bergmann and Company, of Berlin, from whose factory are now being turned out large quantities of these nickel iron cells for use in and fitted to motor cars for private purposes, the electric drive being either by means of double-side chains with a single motor, having one reduction and differential gear all arranged behind the back axle, or else through ordinary spur gear—the motor being suspended partly from the back axle and partly from the frame as in tramway practice.

A still better method is also adopted in the use of a gearless hub motor on each back wheel; and, needless to say, though the efficiency is perhaps less, the quiet and easy running of such a combination is absolutely perfect. No nearer approach to a flying machine could be desired.

Apart from the driving mechanism, however, which after all is now absolutely standardized from tramway practice, the main features of interest lie in the battery.

This, as compared with the lead cell, at present may perhaps cost no less (though as the manufacture is extended there is no doubt the cost will come down very greatly), and it offers no great saving in regard to total weight for a given output (though improvements are now being worked out which increase the amount of active material very much for the same weight of framing).

The increased life or durability, however, appears to show a tremendous advance: an average of two years for the rough work of motor cars represents a duration that probably not one lead battery now on the market

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can offer, and the reduced cost of maintenance thus achieved is more than enough to justify a very satisfactory outlook for the new type of cell. Moreover, it seems difficult, with average treatment, to seriously injure the cells by heavy charges or discharges. The time of charging may be a third or a fourth that required for a lead battery, and the cost in this respect therefore may be less—not of course in regard to the total energy put in, but rather to the time required for the work.

Time and experience alone can show how far these claims can be substantiated. We understand from several experts whose technical standing is unquestioned that satisfactory proof is available at the present time, that they accept what has been done while still looking forward to yet other improvements. Even now, however, sufficient has been done to prove the value of the new cell for every-day work—more particularly at the outset for motor vehicles employed in urban service where they can radiate from a charging centre over an area at least as great as with any lead battery, that is for a mileage of 50 to 60 on one charge, at an expense for energy and maintenance much below anything that can be claimed for petrol vehicles, whilst the ease, comfort, and safety of working far exceed that of the latter.

We understand that the new cell is now to be demonstrated practically, and shall watch its progress with interest, and hope for the success it appears to deserve.

PATENT LAW AND BRITISH MANUFACTURERS.

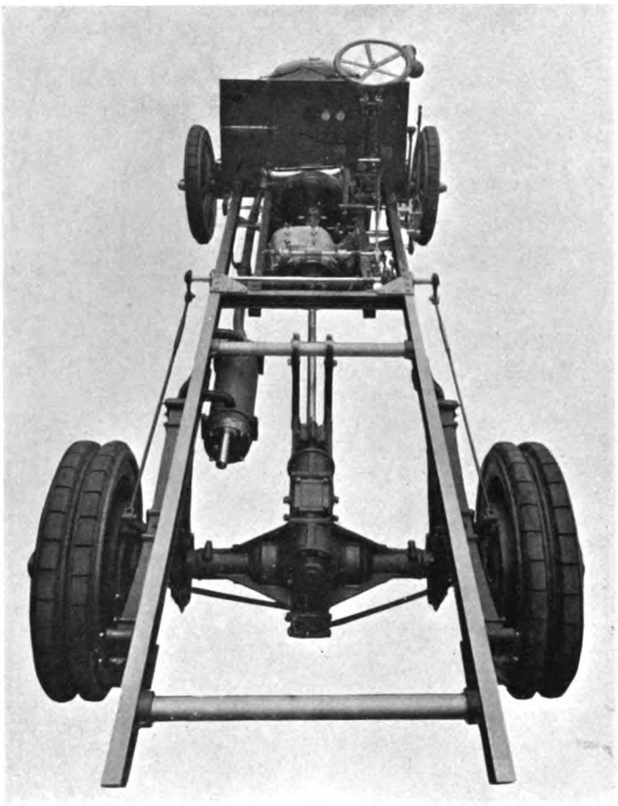
The attitude of the foreigner towards Mr. Lloyd-George's Amended British Patents Act, which comes into force in August, will give the British motor car manufacturer food for thought respecting our present fiscal policy. Under the Act mentioned, French, German, and American holders of British motor patents will, from August next, be compelled to make the patented article in this country or lose their monopoly. That, at sight, appears to confer a benefit upon trade here by giving employment to more mechanics, by the building of factories, and by the payment of wages. To some extent it will also benefit the native manufacturer, because his foreign rival will be compelled to produce his article under the same general conditions of expenditure and prime cost. Naturally, this is not at all to the liking of the foreign patentees, and their organs are making a loud outcry on the wickedness of the British Government in endeavouring to foster its native industries. The following excerpt from the "Kreuzzeitung" is quoted by the *Standard* as an example of German logic:

> England continues to pursue a policy of Protection under a Free Trade mask, and she chooses methods of so doing which must be described as unfair, in view of the fact that German interests are seriously affected thereby. There are grounds to fear that the hostility between Germany and England will again be intensified if the British do not check their protectionist tendencies, and if they persist in putting into operation this new Patent Law, which is incompatible both with free trade and a fair commercial policy.

The unreasonableness of this attitude, remarks the *Standard*, is self-evident. Here is a country which imposes heavy tariffs on our manufactures, and which can dump its productions free of taxes into England, crying out because we ask it to work, or cause to be worked, British patents on British soil. It is interesting to note that Germany alone holds 15,000 British patents, of which no small number are connected with the manufacture of motors.

A DENNIS CHASSIS.

The accompanying illustration shows a substantial and useful 2-ton chassis suitable for a variety of purposes, which is constructed by Dennis Brothers, Limited, Guildford. Like other vehicles built by the same firm the transmission to the driving axle is by worm gearing, which runs very smoothly and noiselessly. The engine, which is of 28 H.P., has cylinders of 110 mm. bore by 130 mm. stroke. Forced lubrication is effected by a pump in the base chamber below the crank shaft. There are two ignitions, geared from timing wheels, which are



Dennis 2-Ton Chassis.

entirely enclosed. The radiator is of cast-iron, thus effecting a saving in price, and the sides of it can be taken apart for the insertion of fresh tubes. The whole radiator is so hung as to allow of expansion. Between the clutch and the gear-box is fixed a cardan square, which allows for any lack of alignment between the two, and facilitates attachment and detachment. Another point is that the direct drive is on the third speed, the fourth being got by gearing up. The whole chassis is well-made and handsomely finished. At the 1st commercial vehicle show, at Olympia, a similar machine was on view, and attracted a good deal of attention.

STREET DANGERS.—In the House of Commons on June 2, Mr. Gladstone, the Home Secretary, replying to a question by Mr. J. F. Remnant, stated that the Commissioner of Police was aware that the heavy traffic of all kinds which passes along Theobald's Road renders it dangerous as a thoroughfare. The two chief points of danger are the junctions with Southampton Row and Gray's Inn Road, and at each of these places there are two constables regulating the traffic, and a police patrol has recently been stationed to prevent dangerous driving on the section between these two points. The omnibus companies have also been asked to instruct their drivers to exercise special caution on this route.

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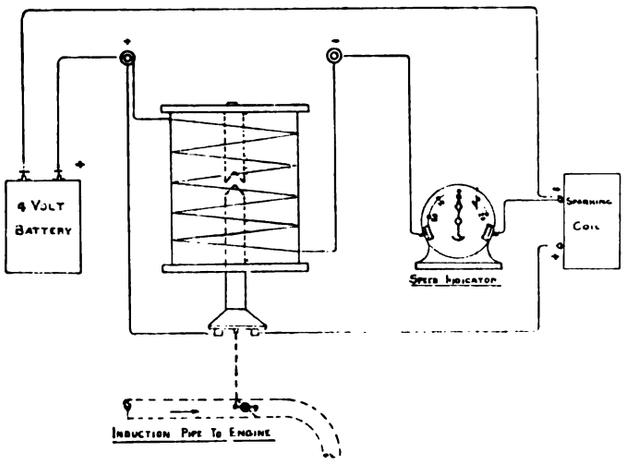
AUTOMATIC SPEED CONTROLLER.

A simple and effective speed controller, or speed arrester, is now upon the market, and is supplied by Messrs. W. Wood and Company, of 110, Cannon Street, London, E.C. It is designed to comply with Board of Trade regulations respecting speed limits on electrically or mechanically-propelled vehicles.

It will be remembered that a regulation, framed by the Board of Trade, was issued in the early days of electric traction, which reads as follows: "If, and when required by the Board of Trade, every motor carriage shall be fitted with an apparatus to indicate to the driver the speed at which it is running, and shall be fitted with a governor which cannot be tampered with by the driver, and which shall operate so as to cut off all electric current from the motors whenever the speed exceeds 10 miles per hour."

The patentee of the present automatic device claims that this control may be effected in a simple and inexpensive manner. The apparatus consists essentially of a speed indicator with movable contacts which may be set at any point.



Automatic Speed Indicator.

Immediately a pre-determined speed has been attained the needle, or pointer, of the tachometer, or speed indicator, makes contact and closes a battery circuit, thereby energising a solenoid, which, when the device is applied to tramcars, trips an armature and opens the car circuit-breaker, and, if required, automatically applies a brake by short-circuiting the motors through the usual resistance carried on the car, and, in some instances, closes a circuit from the power supply through the magnetic brake.

The device may be readily fitted to any make of speed indicator, is eminently suitable for motor cars, and is capable of automatically governing an engine within any pre-determined speed.

When fitted to petrol engine cars or motor 'buses, immediately the maximum permissible speed is exceeded the engine is throttled down by the closing of a valve in the supply or induction pipe, and as soon as the speed falls the valve is opened again. In short, the device effects the same purpose as a sensitive governor on a stationary engine, but, having no friction, or inertia, or counter-weights, the movement is definite, and it cannot be tampered with by the driver of the vehicle.

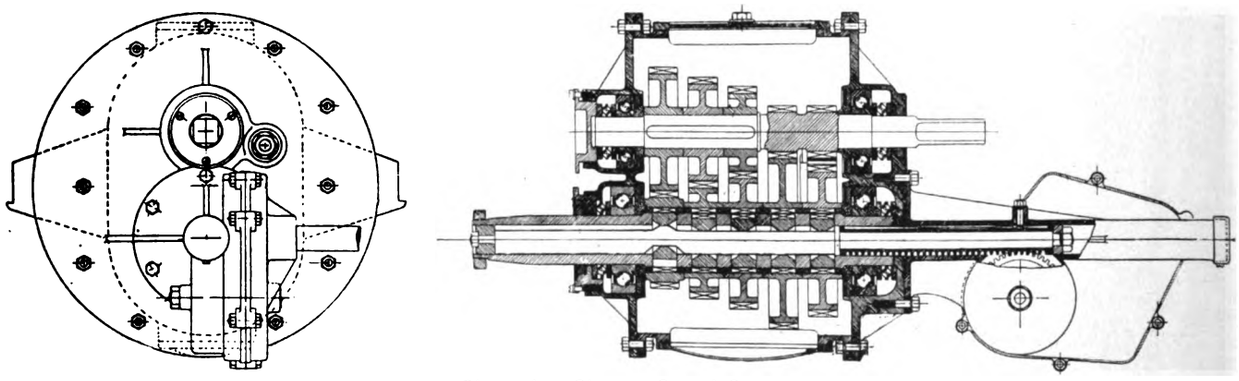
It is well known that, although motor 'buses are licensed to run at a maximum speed of 12 miles per hour, and motor cars at 20 miles per hour, that limit is often exceeded, with the inevitable result that fines are being imposed almost every day in some parts of the country, but, with the fitting of this device, the driver cannot exceed the prescribed limit.

The diagrammatic sketch of the device is self-explanatory.

CHURCHILL CHAR-A-BANC.

Our illustration shows a Churchill motor char-a-banc on tour through the Derbyshire hills. The vehicle is of the well-known type manufactured by Messrs. Durham, Churchill and Company, of the Hallamshire Motor and Engineering Works, Sheffield. It is fitted with a 4 cylinder 24-30 H.P. Aster engine, and has seating capacity for 26 passengers, and we understand it is giving complete satisfaction. The special features of these vehicles are the "champion" patent friction clutch, the universal joints, and the "champion" patent change-speed gear. The latter is of considerable interest, as the change-speed gear is one of the vital parts of a motor vehicle, and most likely to be damaged by an inexpert driver. The "champion" change-speed gear consists of a hollow shaft with rectangular holes slotted right through; small blocks, having teeth formed on one face, are loosely mounted on a rod having a cane in its centre, each block being fitted into one of the holes in the shaft; and a number of gear wheels mounted loosely on the hollow shaft with teeth of a special form cast inside the hub. As each of the gear wheels is placed directly over one of the blocks, it follows that when the block is raised by the movement of the cane rod it instantly locks the wheel over it to the shaft. Each wheel on the hollow shaft is always in mesh with a corresponding wheel mounted on, and permanently fixed to a shaft placed parallel to the hollow shaft, so that the power rotating the hollow shaft is at once transmitted for

Churchill Char-a-Banc.



Champion Change Speed Gear.

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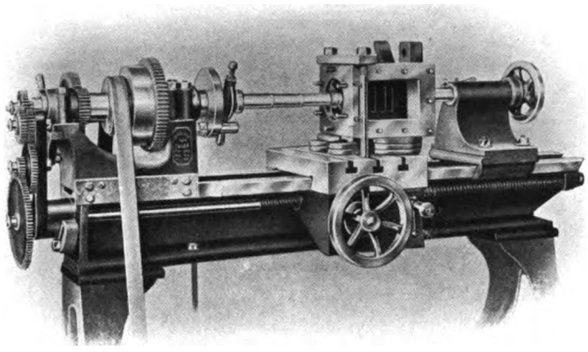
propelling purposes through any desired train of wheels. It is claimed for this system that it is practically impossible for a driver to "miss a gear" as owing to the whole of the inside of the hub of each wheel being toothed, the teeth of the block are bound to engage whenever the block is raised, and as the teeth are almost semi-circular the engagement is very easy, and there is no chipping or breaking of teeth. The reverse is obtained by the intermeshing of a third wheel in the usual way. Any number of speeds can be provided for. We give two views of this patent gear, from which a good idea is obtainable of its rigidity and compactness.

A USEFUL TOOL.

Machine tools play a large part both in the manufacture and the repair of heavy chassis, and probably no more generally useful tool for such



A Lathe by Drummond Brothers.

purposes can be found than the new high-speed all-gear head heavy lathe which is here illustrated. It is made by Drummond Brothers, Limited, Guildford, and is capable of an unusual variety of work. The heaviest roughing cuts using high-speed steel and the finest class of small work are within its range. The traversing boring carriage is of a new design. It has a reversing motion for screw cutting by lever on the apron so arranged that screws cannot be crossed in cutting, and it has a gap bed of novel form, the saddle having no overhang even when the gap is is use. The saddle only bears on the lower tier, leaving the upper tier free from wear. There is thus no derangement of the poppet or the tail-stock which rests on the upper tier, and the centres are kept true. However far the poppet barrel is out there is always the same bearing length. The machine may be regarded as one of the best for all round work produced by a firm who have specialised in the manufacture of lathes.

THE INDUSTRIAL MOTOR EXHIBITION.

Pressure on space prevented notice being given in our issue of May 7 to several exhibits of interest at the recent Industrial Motor Vehicle Exhibition at Olympia. The following notes are supplementary to those which we published in May:

Mann and Overtons, Limited.—This firm showed two "Unic" 10-12 H.P. vehicles, one fitted with a cab body similar to those running on the London streets, and the other with a 15 cwt. van body. This was the identical van which gained a gold medal in the R.A.C. trials last autumn.

Mann's Patent Steam Cart and Wagon Company.—This firm's exhibit consisted of a 5-ton steam wagon, fitted with a locomotive type of boiler and compound engine, rated at 30 H.P. The drive is by means of Mann's well-known system of spur gearing.

The St. Pancras Iron Works Company.—This company were showing one of their 50 H.P. steam wagons, a similar vehicle to those which are doing most satisfactory work in the sanitary department of a large number of the municipal corporations. The wagon is designed to carry a load of five tons, and draw a trailer with a load of three tons. It is fitted with a platform 12 ft. by 6 ft. 6 in., and has the firm's patent radial return tube boiler.

Willans and Robinson, Limited, of Rugby, had an exceptionally fine range of castings on view. These were in various metals, and included motor cylinders, pistons, and piston rings, also some intricate castings for launch and boat work.

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THE ROYAL AUTOMOBILE CLUB.

The recent acceptance by Prince Francis of Teck of the position of chairman of the Royal Automobile Club may be said to be the beginning of a new development which, says the *Evening Standard*, promises to revolutionise Clubland, and may possibly have a marked effect on the hotel and restaurant life of London. The Royal Automobile Club, of which the King is patron, has bought, as everyone knows, the site of the old War Office in Pall Mall. Here a club-house on entirely new lines is to be erected. It will contain all the best features of the hotel de luxe. French styles will be introduced. Its reading-room will take the form of a winter garden. There will be a large number of bedrooms and a bathroom to each. Ample space will be devoted to the restaurant, which will be run on the same lines as the best ones in London. Banquets will be fairly frequent, and private parties will be a daily feature of club life. Members will be allowed to introduce ladies. Supper after a theatre will be a special attraction, for it will be enjoyed in peace, with no cry of "Lights out!" followed by a hasty scramble. One room, and one room only, will be consecrated to the old club life. Its furniture will be entirety of mahogany and mulberry-coloured leather.

The Royal Automobile Club of the future will strike a death-blow at the club as we know it to-day. The scheme and plans of the club are being watched closely in the catering world, more especially in view of the present Licensing Bill. It is obvious that in face of recent severe competition any further State-created restrictions must tend towards disaster. It is even possible that in the future some of London's hotels may form themselves into clubs simply from motives of self-protection.

MOTOR OMNIBUS NOTES.

A Motor Coach Service has been started between Folkestone and Tunbridge Wells.

Dust Trials.—The Royal Automobile Club propose to hold further dust trials on the Brooklands Track early in July. There will be, as was the case last year, three classes, viz.: makers' standard cars, amateurs' cars, and experimental cars.

A New Kind of "Protection."—Scarborough Town Council having received an application from a company for permission to run taximeter cabs, have resolved to license these cabs, on condition that for each such cab licensed the company should purchase one horse-drawn cab already licensed.

London to Brighton Motor Trips.—During the summer season the Daimler Company will run 42 H.P. motor cars every Sunday from London to Brighton and back. The cars will start from several of the principal London hotels. The fares are 12s. 6d. single, and 15s. return.

Petrol-Electric 'Bus at Brighton.—The Hallford petrol-electric omnibus, which was exhibited at the last motor show at Olympia, London, is now in service at Brighton, being run by the Brighton and Hove Motor Omnibus Company. It is similar to the Hallford vehicle which Thomas Tilling, Limited, are running in London.

Manchester and Motor 'Buses.—Possibly because of the doleful experience of a motor 'bus company some time ago, Manchester Watch Committee are very cautious about new applications. At a meeting on May 21 they decided to postpone coming to a decision on an application for permission to run motor 'buses in the suburbs till further information could be obtained from the chief constable and the city surveyor as to traffic requirements, etc.

A Protest against Motor Traffic.—The Lord Mayor of London, in response to a requisition of citizens, has called a meeting at the Mansion House for the purpose of directing attention to what the signatories describe as the excessive danger, annoyance, and inconvenience caused by the speed, noise and noxious fumes of motor omnibuses and traction engines in the city of London. The meeting has been fixed for June 22 at 3 p.m.

Torquay Road Car Company.—The report on the first year's working of this company shows that the receipts were £2,905, and the expenses, including preliminary and formation expenses, were £2,611. After deducting depreciation at 10 per cent. on the five cars used, there remains a profit of £79 15s., which is carried forward. The directors have arranged to work the steam 'buses of the Paignton and District Motor Omnibus Company on terms which are considered advantageous.

Motor Cab Driver in Trouble.—Comparatively few prosecutions of motor cab drivers for reckless driving have so far been reported, and, considering the speed and mobility of the vehicles, the fact speaks well for the class of men employed. A driver was, however, fined £10 and 23s. costs at West London Police Court on May 23 for failing to stop after an accident. The cab had collided with a cyclist, and the cab driver drove speedily away.

Motor Cabs and Return Fares.—Mr. Herbert Gladstone, Home Secretary, has stated in a printed reply to a Parliamentary question that taxicab drivers are not entitled to demand return fares inside the Metropolitan Police district. Outside the district the Home Secretary has no authority to prevent a driver making an arrangement with the hirer for the payment of a return fare, and he understands that drivers have been instructed not to accept fares outside the district except in consideration of some return fare.

Mr. C. D. Rose, M.P., having intimated that he was unable to undertake the duties of chairman of the Royal Automobile Club, to which office he was recently re-elected, the committee of the club have appointed Prince Francis of Teck to be chairman. Mr. Rose has found it necessary to visit Canada for a time, and so cannot attend to the duties of chairman. The committee have asked him to accept a vice-presidency of the club in recognition of the unique services he has rendered to it and to the whole automobile movement.

Luxurious Omnibuses.—The General Motor Cab Company are experimentally running in the west end of London a new and luxurious type of motor 'bus, built by Charrons, Limited. The vehicle is a single-decker, and seats only nine passengers. It is luxuriously appointed inside, and the seats are upholstered arm chairs. The route is from Portland Place to Cromwell Road, South Kensington, and the fare for any distance is sixpence. Only in the west end of London, probably, could there be a chance of such a venture paying. The 'buses are easily recognised by the word "Pullman" in large letters along the sides.

Motor Mowing Machines for London.—At a meeting of London County Council on May 12, the Parks Committee presented a report on the question of obtaining motor mowing machines for use in some of the larger parks. A 42 in. machine had been in use at Victoria Park for over three years, and the committee were of opinion that seven additional machines should be purchased. By this means it would be possible to carry on mowing at times when the ground was unfit for the use of horse machines, and owing to the absence of hoof marks and the motors serving the purpose of rollers, the condition of the surfaces of cricket and other grounds would be materially improved. Moreover, it was anticipated that the cost of the machines would be recouped within two years by the saving of labour and horse hire. Ransomes, Sims, and Jefferies, Limited, were prepared to supply machines for £150 each, and Alexander Shanks and Son, Limited, for £180 each, subject in each case to a discount of 5 per cent. The Committee had come to the conclusion that four machines should be obtained from A. Shanks and Son, and three from the other firm.

Attack on Motor 'Buses.—On May 31 something approaching a riot occurred in the East End of London, as a result of a motor omnibus accident. An omnibus was travelling along Mile End Road when, at the junction of Cambridge Heath Road, three children tried to cross in front of it. A man succeeded in pulling two of the children out of the way, but the third was killed. The driver did his best to avoid the accident. A crowd quickly collected and raised angry cries against the driver. The latter was roughly handled, but was rescued by the police. The mob threw stones and other missiles at the 'bus, from which the passengers speedily escaped. An attack was also made on another motor 'bus, and the mob was only dispersed after a large force of police had arrived. Arrests were made, and fines were inflicted at the local courts on Monday.—In the House of Commons on June 2, attention was called to the accident by Mr. Timothy Davies, Liberal Member for Fulham, who asked the Home Secretary if his attention had been drawn to the occurrence, and what steps would be taken for the safety of children and old people. Mr. Gladstone replied that his attention had been drawn to the accident. The police had cognisance of 36 fatal accidents caused by motor omnibuses in the metropolitan area in 1907, but the fatal accidents caused by horse-drawn vehicles were four times as numerous. He would call the special attention of the police to the necessity for strictly enforcing the traffic regulations in streets where children were apt to congregate.

Mail Motor Vans.—The carrying of mails by petrol motor vans is steadily increasing. A new service has been started between London and Aylesbury. The 18 H.P. Siddeley van which is being used, is supplied by the Wolseley Tool and Motor Car Company, Limited. It leaves Aylesbury at 7-30 each evening and calling at Tring, Berkhampstead, Two Waters, Kings Langley, Watford, Stanmore and Edgware to take up, arrives at Mount Pleasant, London, just before midnight. Less than half-an-hour later it starts back again, and

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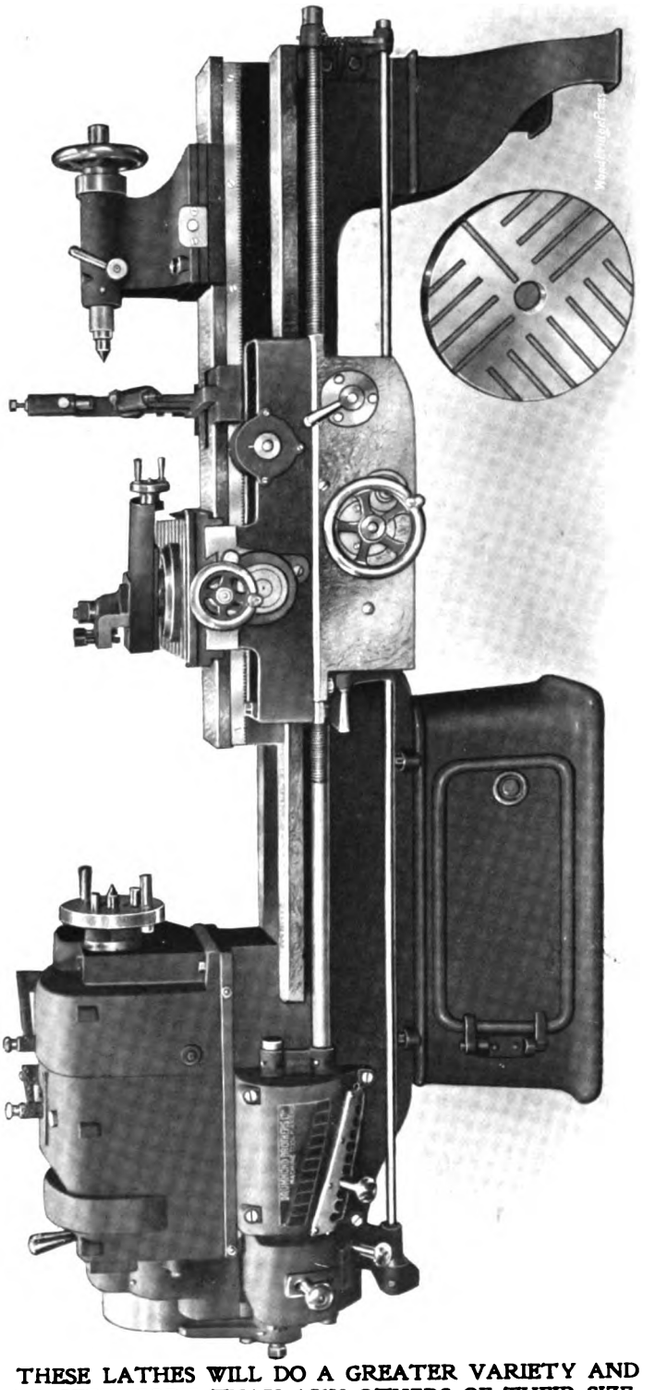

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stopping at the same places as on the up journey, reaches Aylesbury again just before five. The distance run is just over 40½ miles each way. The van carries in addition to the mails a sorter whose operations are conducted by acetylene gas light for which an installation has been fitted. The same driver makes both journeys.

Society of Motor Manufacturers and Traders.—A meeting of the agents' section of the Society of Motor Manufacturers and Traders was held on May 21, Mr. W. M. Letts in the chair. The meeting was called in accordance with the decision of the council in order that the section might consider whether they would elect a committee. It was unanimously resolved to continue the work of the section through a committee as before, the maximum number being fixed at twenty-five. The following committee was elected: Messrs. A. R. Atkey, B. Coathupe, H. Carver, A. Farnell, T. Garner, R. E. Hale, A. C. Hills, J. E. Hutton, H. E. Hughes, W. N. Letts, H. J. Lloyd, G. N. C. Mann, A. S. Mays-Smith, A. W. C. Hobbs, A. F. Mulliner, C. J. Newey, W. Parker-Thomas, and C. A. Slater. It was resolved that it would be desirable to form a section which would take in the numerous traders round London. Mr. Stafford was directed to inquire into and report on the matter.

Exhaust Gases.—After the vapour emission competition promoted by the Royal Automobile Club in March, 1907, Mr. Dugald Clerk, one of the judges, offered a prize of fifty guineas, to be given to the winner of the next vapour emission competition. It has been decided, however, not to hold a separate competition of this character during the present year, but, in order to encourage makers to give their best attention to this important subject, the Technical Committee decided to ask Mr. Clerk if he would allow his prize to be given to the best car in this respect in a long-distance trial carried out under the observation of the Club. Mr. Clerk has kindly agreed to this arrangement, and a further recommendation is now made that competitors may, at their option, enter for the prize as part of a long-distance trial, or for a special one day trial of about 100 miles on the road.

Prejudice against Motor 'Buses.—A peculiar application was made at Brentwood County Court on May 20, when Judge Atkinson was asked to have certain actions for damages by Ilford Urban Council against the Great Eastern Motor Omnibus Company tried at some other place than Ilford. The actions were for damages to electric standards and a tramcar, and there were counter claims for damages to omnibuses. Mr. T. Ralph, who appeared for the company, said they thought it would be impossible to obtain a really fair hearing in Ilford, owing to the prejudice existing there against the motor 'buses. Mr. A. E. Pearkes (for the Ilford Council), said he would undertake not to ask for a jury. Mr. Ralph: They might want a jury. The Judge said he would take care that the jury did not come from Ilford. Mr. Ralph said that the Ilford Council had been running trams, and had suffered from the 'bus competition. He would like the cases tried in the City of London Court or Bow County Court. The Judge said that he had no right to transfer Essex cases to the Metropolitan courts. There was Chelmsford. Mr. Ralph said that his clients preferred Ilford to Chelmsford. His Honour ultimately appointed a special day, July 11, for the hearing, at Ilford.

Motor 'Buses and Oil Nuisance.—At the Mansion House Police Court, London, on May 4, four cases were heard against drivers of motor omnibuses of the London General Omnibus Company and the London Road Car Company. The charge was one of contravening the by-laws framed under the Public Health Act, 1891, by causing thick black oil to be cast on the roadway in Cornhill and Ludgate Hill. Mr. Vickery, in support of the summonses, said the proceedings were taken with the view of putting a stop to a dangerous and objectionable nuisance caused in the City by the dropping of oil from motor omnibuses. To illustrate the extent of the nuisance a return that had been made showed that for the week ending April 19 there were 172 offences of this kind in the City, and for the week ending April 26 382 cases. This was the first prosecution of its kind in the City. The nuisance was due either to carelessness on the part of the drivers or a defect in the tray fitted to the vehicles to catch the oil from the engine. The Lord Mayor said this was a very proper prosecution, and one which ought to have been taken before, but he was of opinion that the companies were as much responsible as the drivers, and that they ought to indemnify the men in respect of penalties incurred. He imposed a nominal penalty of 2s. with 3s. costs, on each of the summonses.

Heavy Damages against an Omnibus Company.—In the King's Bench Division of the High Court of Justice, on May 19—before Mr. Justice Jelf and a common jury—Mr. F. R. Morgan, an engineer's commercial traveller, sued the London General Omnibus Company for damages in respect of injuries received by being run into by a

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motor 'bus belonging to the defendants. His case was that the 'bus was driven negligently on the wrong side of the road, and that no warning was given of its approach. He was permanently injured and unable to follow his occupation. He had been £180 out of pocket up to date. The defence was that the accident was due to the plaintiff not keeping a proper look-out, and to his getting in the way of the 'bus, so that it was not possible for the driver, although he exercised all possible skill, to avoid the accident. The jury found for the plaintiff, and awarded him £1,000 damages. A stay of execution was asked on the ground that the damages were excessive, and Mr. Justice Jelf said he would consider the matter and give his decision on the following day. On the case being called on Wednesday, it was intimated that a stay had been arranged between the parties on terms which were not made public. The Judge said he was glad the parties had relieved him of the duty of deciding the question, which was of some difficulty.

Road Maintenance in Lancashire.—At a meeting of Lancashire County Council, held in Preston on May 7, Mr. Wade Deacon, chairman of the Finance Committee, in submitting the budget of the current year, said that the Main Roads Committee estimates showed the very large increase of £13,152. This was in part owing to there having been a very great increase in the weight of the traffic which passed over the roads and the heavy motor cars now used. The Committee strongly urged the Council to agree to increased expenditure. Certain approximate conclusions had been arrived at, which showed that in the Lonsdale division there would be a decrease in the rates of 1·24d., and in the other divisions the following increases: Amounderness, 1·16d.; Blackburn, ¾d.; Leyland, 11·24d.; Salford, 7·15d.; and West Derby, 9·16d. The amount to be raised was £347,854, an increase on the previous year of £14,151. Mr. Shuttleworth, in submitting the report of the Main Roads Committee, said that about two years ago a sum of £500 was asked for to conduct dust-laying experiments. The Committee had not yet arrived at a satisfactory method of dealing with the difficulty, but some advance had been made in their inquiries, and certain conclusions had been arrived at. They asked for a further grant of £500 for further experiments. The Committee had come to the conclusion that there would be a substantial increase on that already asked for, because of the work involved in the treatment of Lancashire roads, necessary by the heavy motor-wagon traffic. That increase was estimated at £2,670, or a total of £15,822. The report was adopted.

The Future of the Omnibus.—Presiding at the annual meeting of Thomas Tilling, Limited, the well-known London omnibus owners and jobmasters, Mr. R. S. Tilling said that the decline in the receipts of the omnibus traffic was owing to the exceptionally cold weather, and to the competition of the electric tramways and motor omnibuses. The London County Council tramways were being run at fares which could not be made profitable by any company. As to the motor omnibus, the first full-sized petrol omnibus was run by their company in London, and that was less than four years ago. He stated at that time that it was their intention to substitute motor for horse traction very gradually, and in this policy they were supported by the boards of all the then existing established omnibus companies. But along came the inevitable company promoter, who flooded the streets of London with motor omnibuses, and the existing companies, in sheer self-defence, ordered more rapidly than otherwise they would have done, the vehicles proving unsuitable. The older companies were faced with two alternatives, to abandon the motors altogether or to reconstruct them. The latter course was decided upon, but the reconstruction of the vehicles had cost much money, but this in their case had been met out of revenue. From their experience they believed that the motor omnibus was the vehicle of the future. The cost of reconstruction had prevented their motor omnibus branch from showing a profit, but they believed they could make it as profitable as the horse omnibus had been in the past. The private work done by the company constituted more than one-half of their business. They had successfully overcome competition in the past, and he believed that the latest rivalry also would be successfully met by them. In reply to the question, he said that he believed the accumulators used by the electric 'bus had made no advance during the past fifteen years, and, in his opinion, the enormous weight such a 'bus had to carry would prevent it being run at a profit. They themselves, however, had a petrol-electric omnibus, partly invented by their own engineer, and this promised favourable results.

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JUN 25

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WITH
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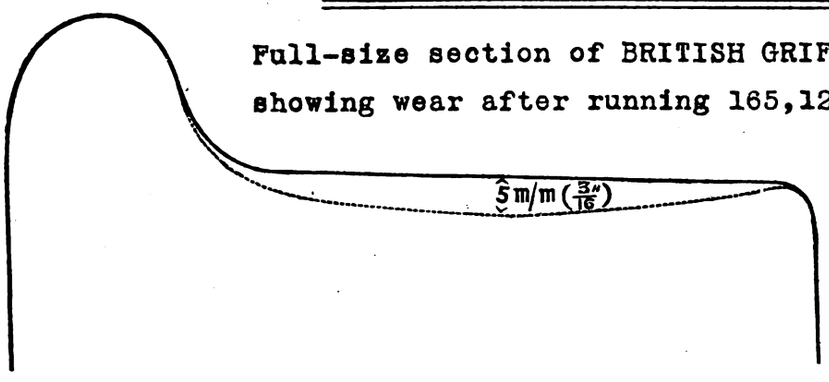

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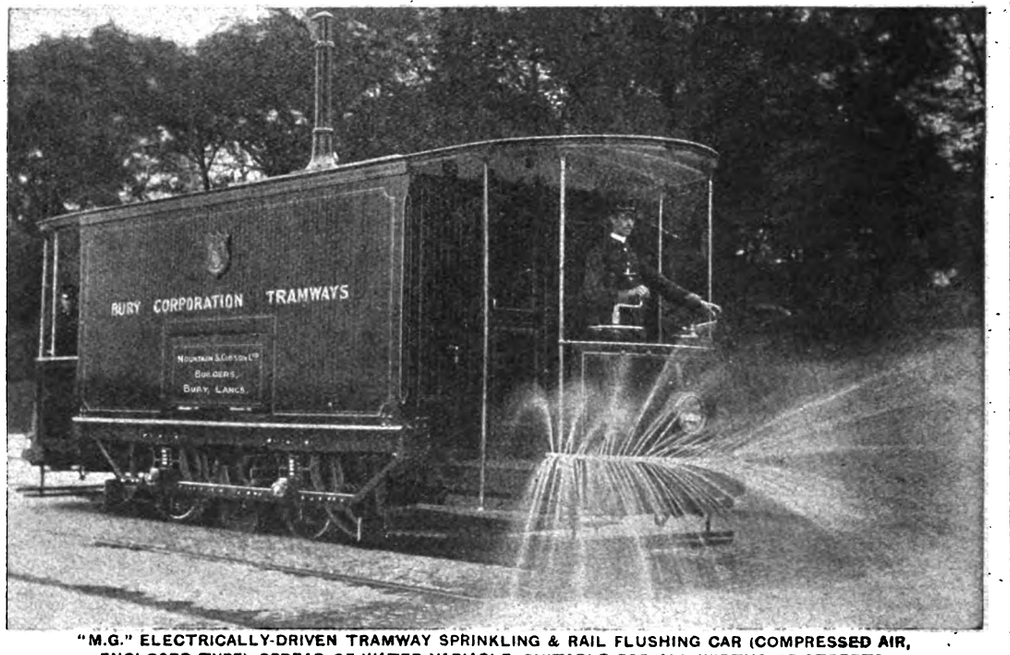

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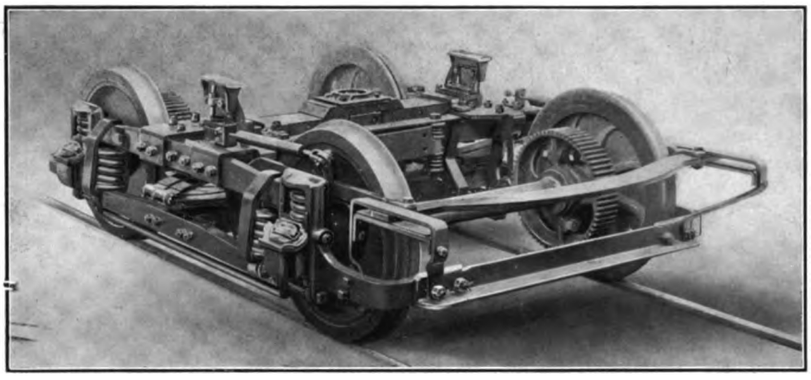
PARTICULAR attention is called to the fact that in the Brill High-Speed Truck No. 27-E, provision is made for the cushioned side swing. Most of the recent disasters to trains on steam roads while rounding curves at a high rate of speed have been caused, not by broken rails, but by the absence of cushioned side swing in the trucks. The average speed of electrically-operated cars on interurban lines in the United States is higher than on steam roads, while the average track conditions are much inferior, and the curves more frequent and of shorter radii; yet the Brill No. 27-E Truck, which is used on the greater majority of these electric lines, has never been derailed except in collisions. It is the only high-speed truck that has a cushioned side swing. The swing bolster used in "M.C.B." types and all other trucks, is uncushioned, and, therefore, when curves are taken at more than moderate speed, the swing stops with a jerk which drives the wheel flanges against the outer rail head with dangerous and sometimes fatal force. The Brill No 27-E Truck is used on one hundred and twenty-five interurban systems in the United States. ¶ The easy riding qualities of the No. 27-G Truck, both on curves and tangents, are due to the elastic, yet steady, spring arrangement, comprising three sets of springs working in series and leaving no motion uncushioned. The suspension of the load upon the frame close to the yokes by means of spring links gives a stability to the frame which obviates the objectionable oscillation when running at a fair speed, common to most short-based trucks. With outside-hung motors frame stability is essential, and the fact that the load is equalised upon the frame as well as on the wheels in this truck, gives it a stability which enables it to run smoothly at thirty miles an hour. Besides giving a wide spring base for the load upon the frame, the spring links amplify the action of the semi-elliptics and cushion the side swing.



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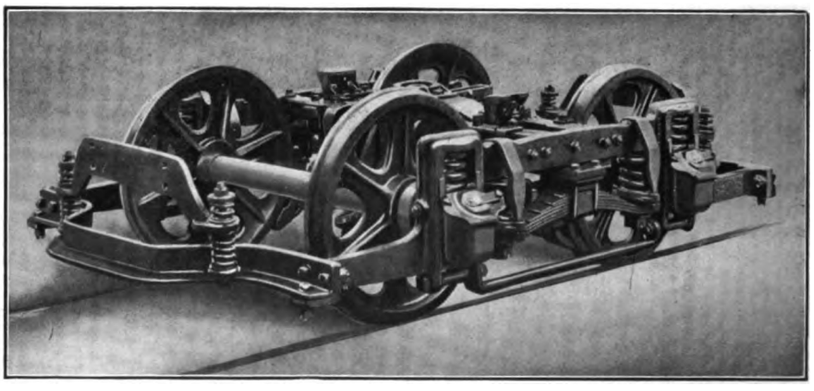

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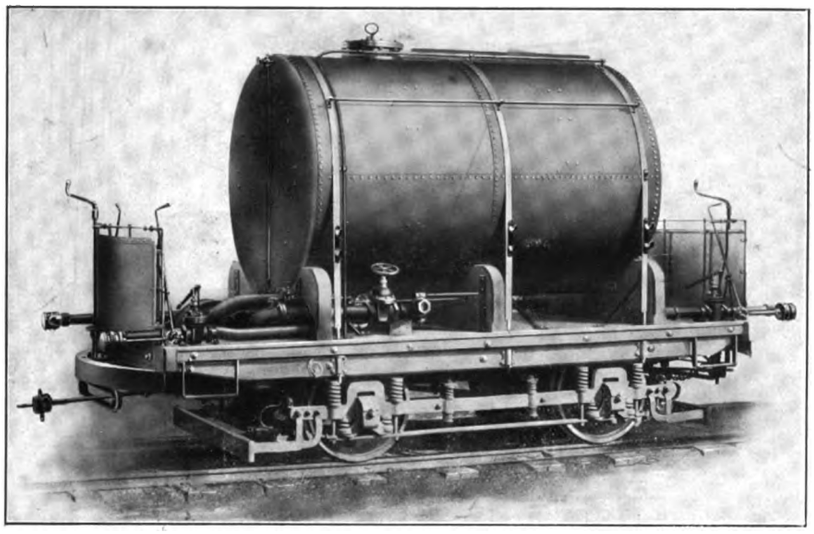

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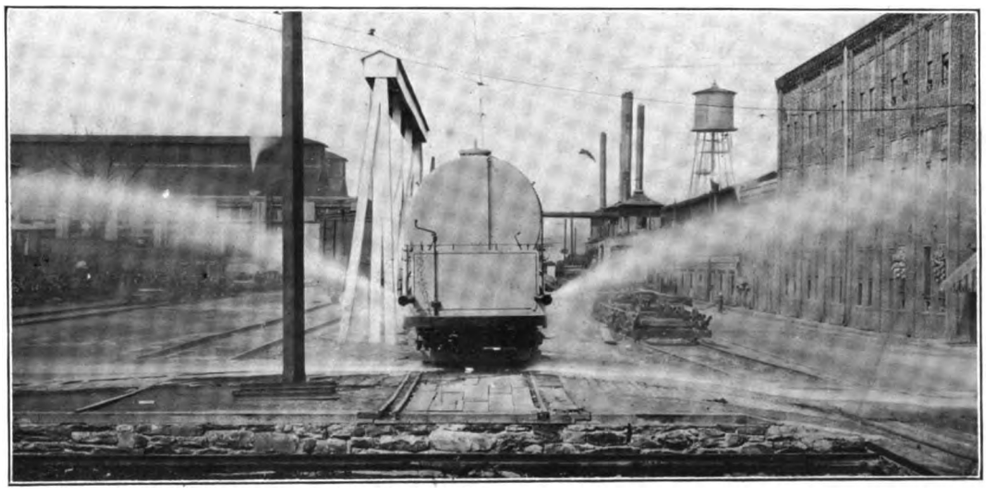

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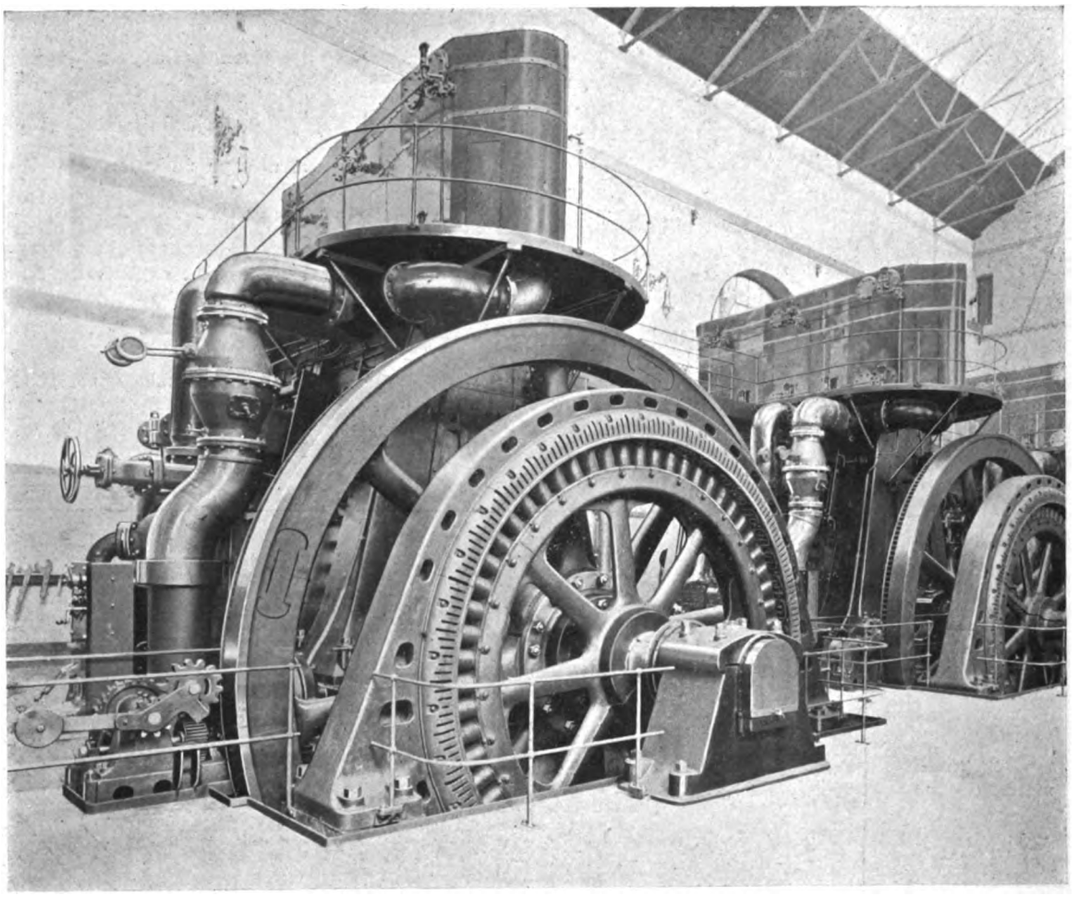

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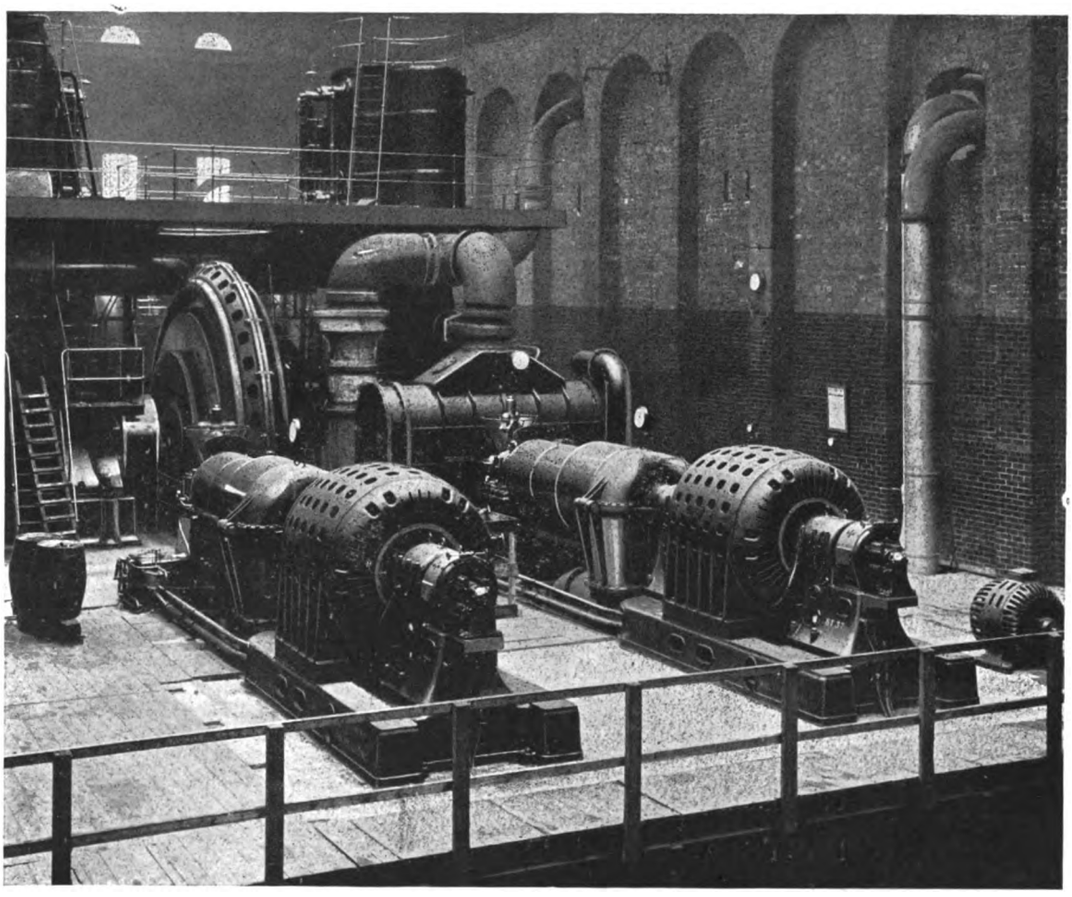

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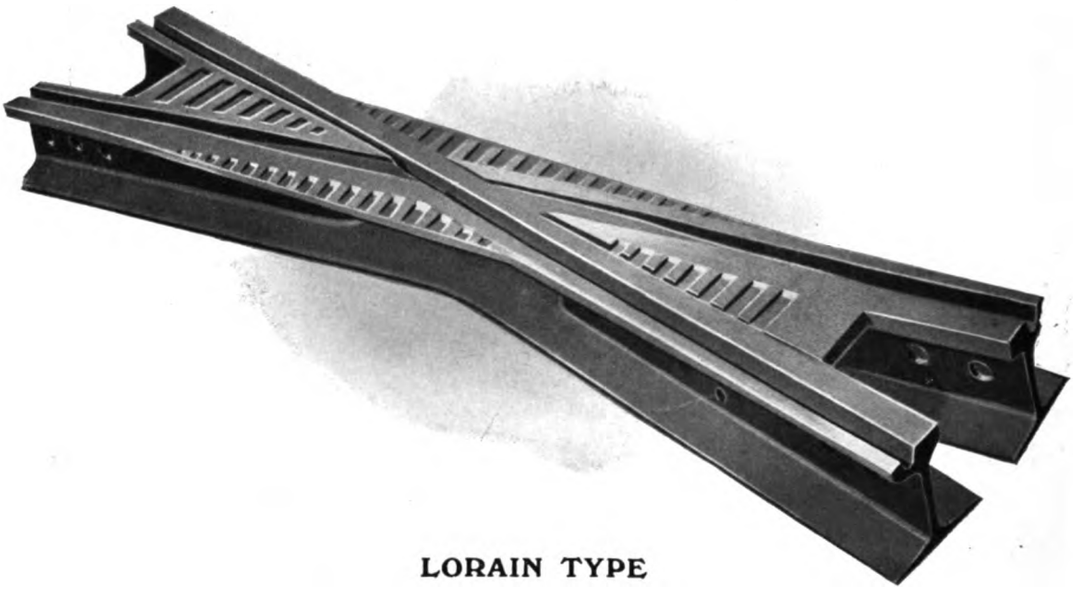

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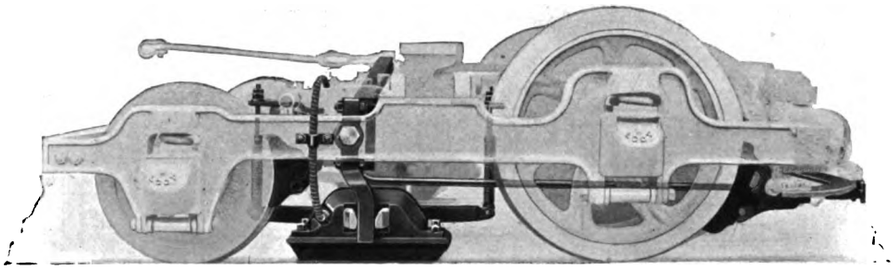

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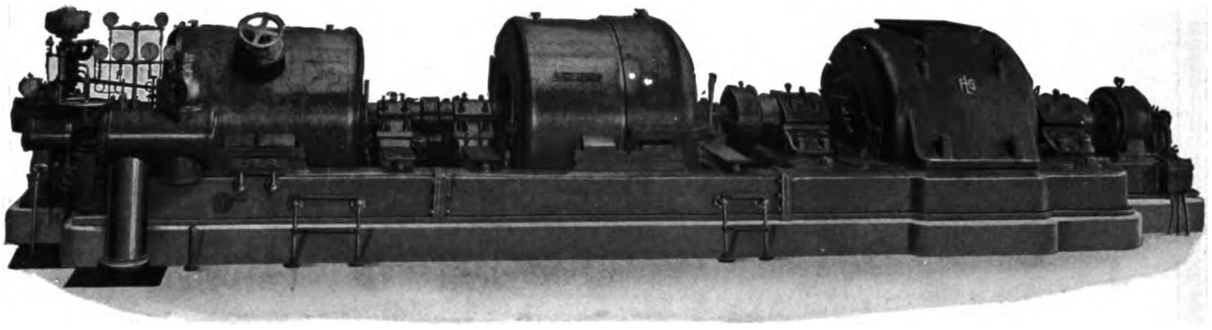

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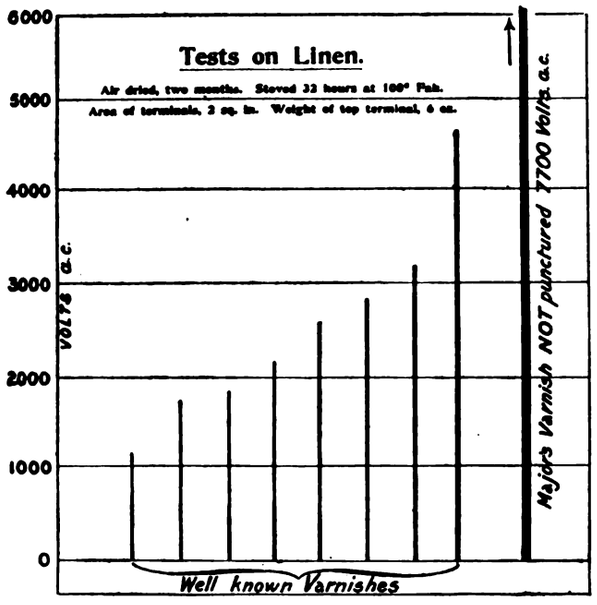

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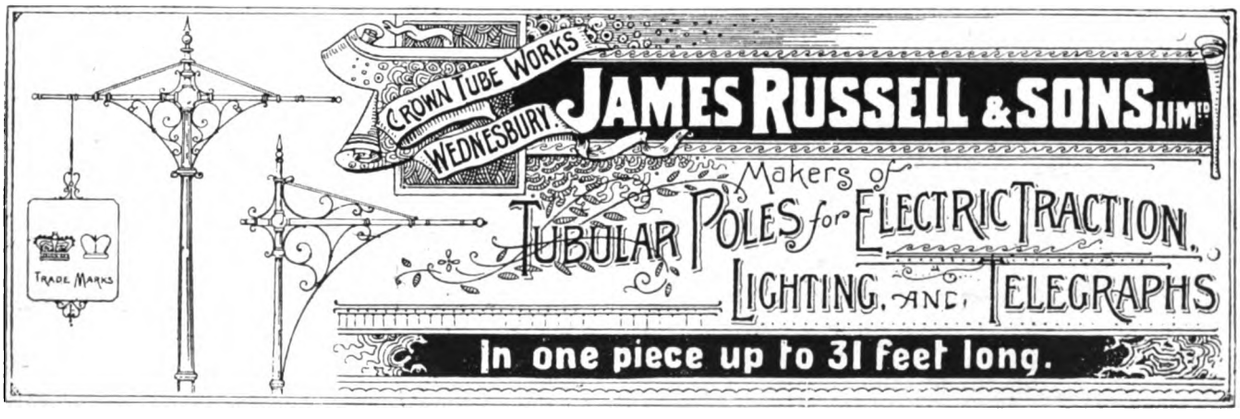

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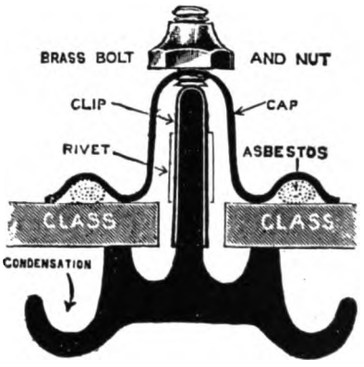

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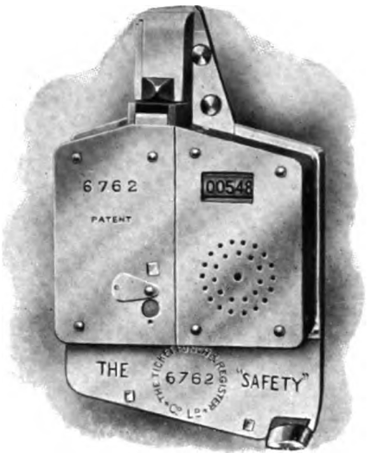

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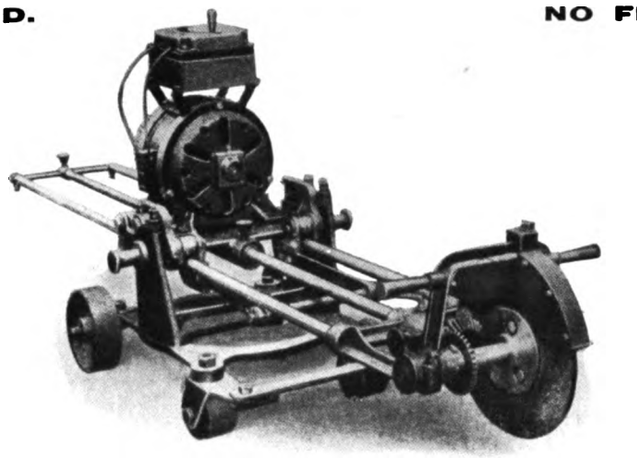

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Tramway Congress, 1908

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PROGRAMME.

9th JULY (THURSDAY).

10-30 a.m.—Reception by Reception Committee, Congress Hall.

11-0 a.m.—"The Tramways of the World."
Lecture by Sir Clifton Robinson, Assoc.Inst.C.E., M.Inst.E.E.

12-0 noon—"Tramway Rail Joints."
Paper by Mr. A. H. Gibbings, Assoc.M.Inst.C.E., M.I.E.E.

10th JULY (FRIDAY).

11-0 a.m.—Mr. A. L. C. Fell, M.I.E.E., M.I.Mech.E., in the Chair. Short Address.

11-30 a.m.—"Rail Corrugation."
Lecture by Prof. C. A. Carus-Wilson, M.I.E.E., Assoc.M.I.C.E., with Illustrations.

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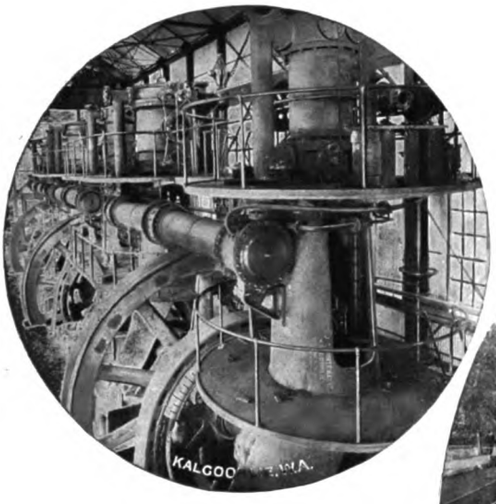

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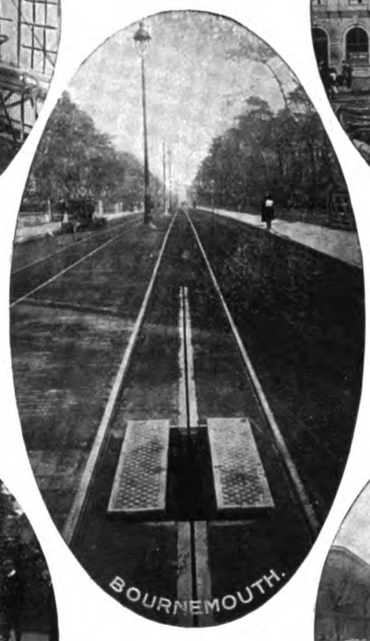

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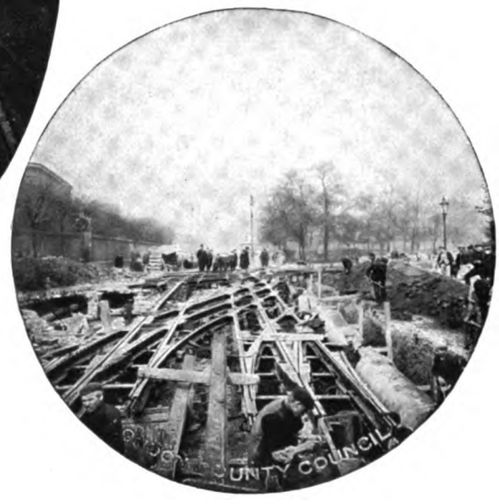

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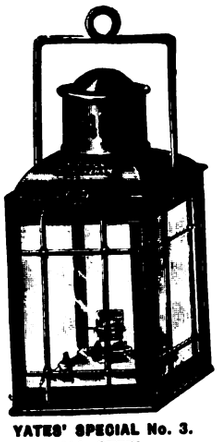

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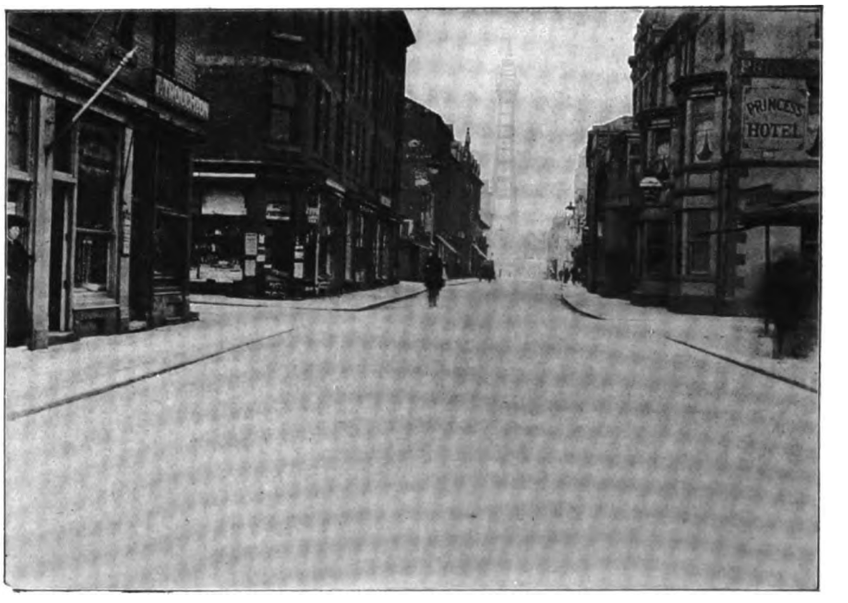

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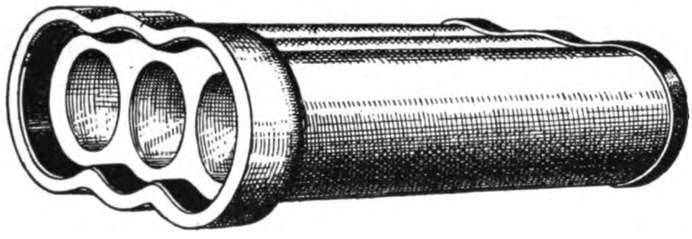

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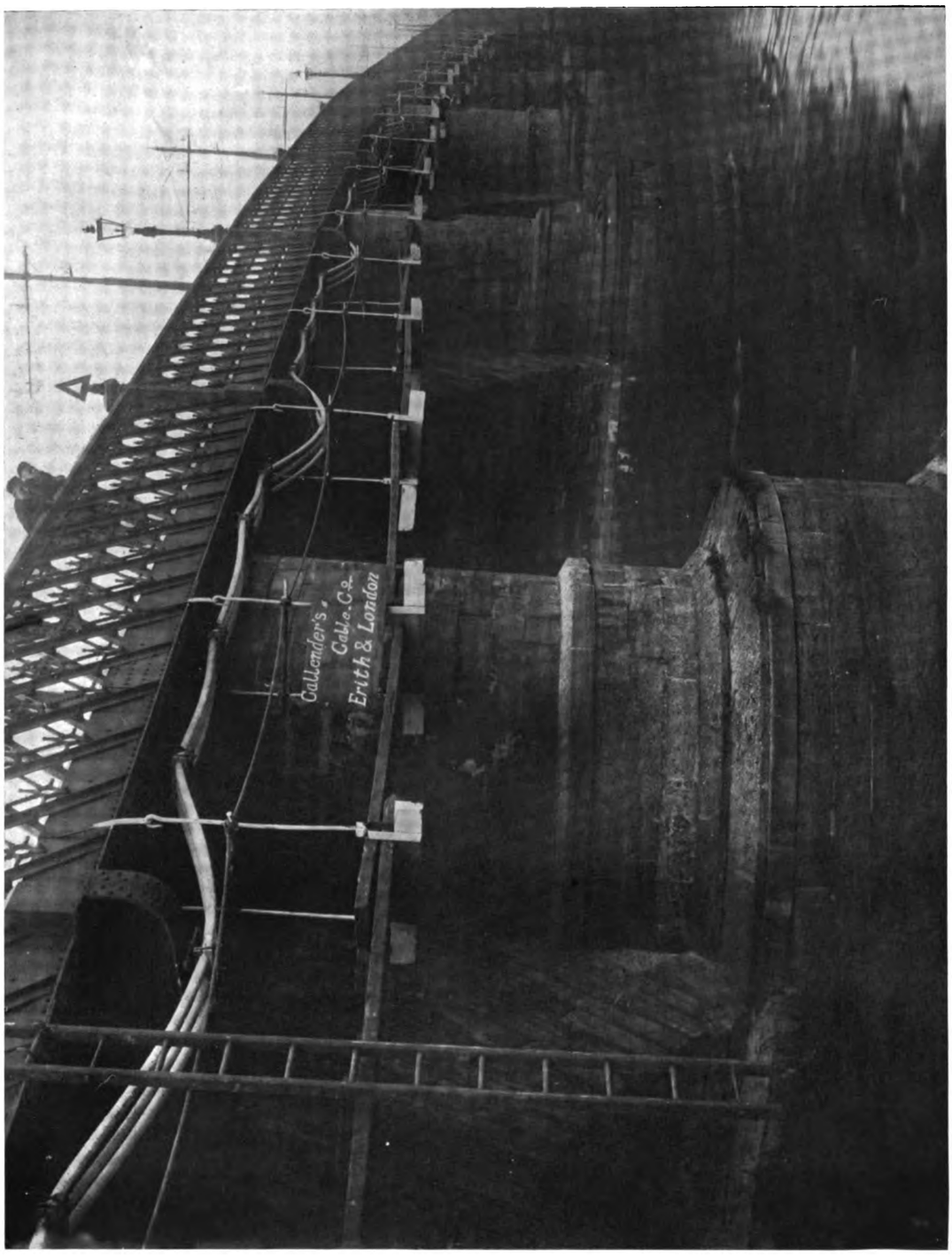

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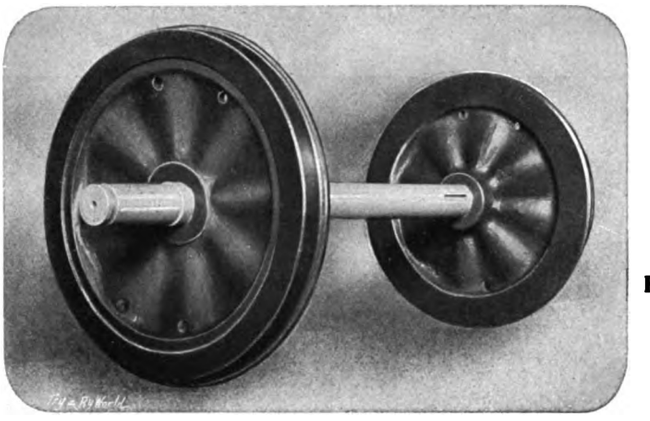

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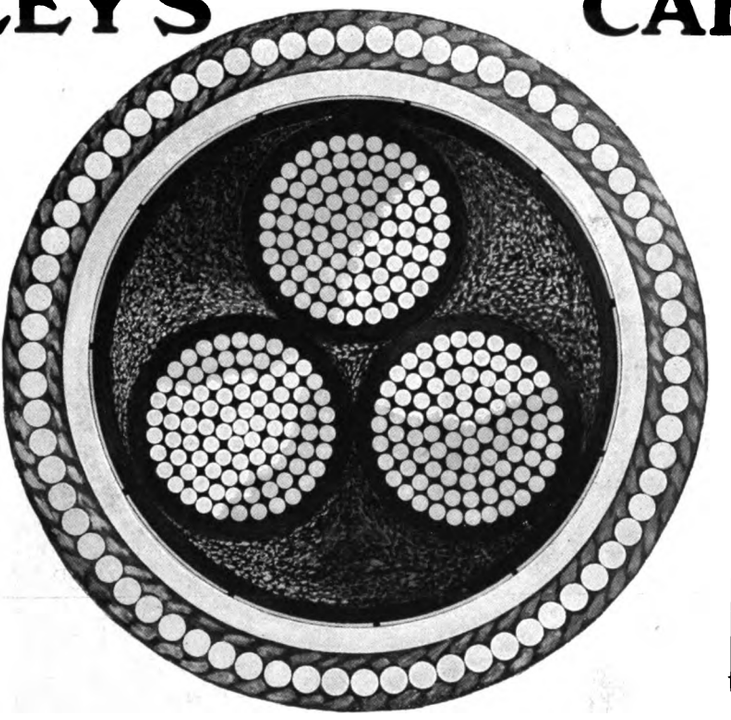

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DIRECTORIES OF TRAMWAYS AND RAILWAYS.

Electric Tramways and Railways in the United Kingdom ... xxvii, xxviii, xxxi, and xxxii.
Electric Tramway Directory xxxiv, xxxv, xxxvi, xxxviii, xxxix, xl, xlii, xliv, xlvi, xlviii, and l.
Directory of Electric Railways ... ... l and lii.

ELECTRIC TRAMWAYS & RAILWAYS IN THE UNITED KINGDOM.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge. ft.	Gauge. in.	Weight and Type of Rail. lbs.	Maximum Gradient. 1 in	Sharpest Curve. ft. rad.	No of Motor Cars.	No of Dynamos	How Driven.	No. of Engines	Type of Engines	Total H.P.	Contractors for Electrical Apparatus.
TRAMWAYS.															
Aberdeen Corporation	Dec., 1899	14·25	25·5	4	8½	96 G	13·2	44	69	*5	D-C.	6	V. Cp. C.	..	Macartney, McElroy & Co.
Aberdeen Suburban Trys. Co. ..	June, 1905	5	5	4	8½	95 G	..	..	9	..	..	..	..	..	J. G. White & Co. Brush Co.
Accrington Corporation	Aug., 1907	7·75	11·75	4	0	95 G	14	..	20	*5	..	5	..	..	Brush Co.
Airdrie & Coatbridge Tramway Co.	Feb., 1904	3·65	4·85	4	8½	94 G	14	210	15	..	..	..	..	..	Brush Co.
Ashton-under-Lyne Corporation .	Aug., 1902	7	9·75	4	8½	98 G	12	40	21	7	..	6	..	..	Dick, Kerr, & Co. Siemens Bros.
Aston Manor Corporation	June, 1904	4·11	8·11	3	6	102 G	15	37	16	5	D-C.	5	..	..	Brush Elec. Co.
Ayr Corporation	Sept., 1901	6	8	4	8½	90 G	21	45	19	*2	D-C.	2	..	600	British T-H.
Barking Town Urban District ..	Dec., 1903	3·2	4·8	4	8½	80&100G	25	44	7	4	D-C.	3	V. Cp. C.	..	Blackwell & Co.
Barnsley & Dist. Elec. Traction Co.	Nov., 1902	3·06	4·24	4	8½	94 G	10	66	12	6	D-C.	6	..	..	J. G. White & Co. Brush Co.
Barrow-in-Furness	Feb., 1904	5·37	7·75	4	0	94 G	14	50	18	..	..	..	..	..	Brush Co. Dick, Kerr, & Co.
Bath Electric Tramways, Ltd. ..	Jan., 1904	14·75	19·25	4	8½	95 G	10·6	37½	40	4	D-C.	4	H.T. Cp	..	Westinghouse
Batley Corporation	Aug., 1903	6·536	10·47	4	8½	104 G	9	40	8	4	D-C	4	..	..	B. I. W. Co. British Elc. Cr. Co.
Belfast City	Dec., 1905	36·625	73·25	4	8½	105 G	19	40	236	3	..	3	D-C.	..	J. G. White & Co. Westinghouse
Bessbrook—Newry (1) .. .. Bessbrook and Newry Try. Co.	Oct., 1885	3	3	3	0	41 V	80	55	2	2	B	1	Hyd. Turb.	60	Mather & Platt
Bexley Urban District	Oct., 1903	5·25	7·5	4	8½	90 G	14	40	16	2	..	2	V. Cp.	..	Dick, Kerr, & Co.
Birkenhead Corporation	Feb., 1901	13·52	23·53	4	8½	100 G	13½	40	59	6	D-C.	6	2 H. Cp.	2,600	Blackwell & Co. British T-H.
Birmingham Corporation	Jan., 1904	34	56	3	6	105 G	13	40	580	..	..	..	..	..	Dick, Kerr, & Co.
Birmingham Trys. Co., City of ..	May, 1901	14	20	3	6	97 G	16	40	48	8	D-C.	7	H.C.Cp.	..	British T-H.
Birmingham and Midland Trys. Co.	July, 1904	11·12	12·87	3	6	85 & 94 G	15	31	40	6	D-C.	6	Cp.	..	Brush Co.
Blackburn Corporation	Mch., 1899	14·125	23·8	4	0	92 G	15	30	60	4	D-C.	4	V. Cp. C.	1,500	British T-H. Blackwell & Co.
Blackpool Corporation	Oct., 1885	9	15	4	8½	96 G	20	36	61	..	..	..	Stm. Turb.	1,290	Elwell-Parker British T-H.
Blackpool & Fleetwood Tramroad Co.	July, 1898	9	15·9	4	8½	56 V 81 G	26	80	31	5	D-C.	5	V. Cp.	800	Mather & Platt Dick, Kerr, & Co.
Blackpool and Fylde Light Ry. Co.	Under cons.	14	14·5	4	8½										
Blackpool—St. Anne's & Lytham ..	May, 1903	7·5	13·7	4	8½	92 G	28	45	40	..	..	..	..	..	British T-H.
Bolton Corporation	Nov., 1899	26	42	4	8½	98G	14	35	96	*6	D-C.	6	V. Cp. C.	3,500	Dick, Kerr, & Co. Blackwell & Co.
Bootle Corporation	May, 1900	4·125	7·75	4	8½	95 G	20	40	55	8	D-C.	8	..	..	Blackwell & Co.
Bournemouth Corporation (2) ..	July, 1902	21·5	29·25	3	6	100 G 66 slot	9	50	81	4	D-C.	4	..	2,200	J. G. White & Co.
Bradford Corporation	July, 1898	54·90	98·82	4	0	102 G	9·8	40	239	11	D-C.	11	V. Cp. C.	3,000	Westinghouse Blackwell & Co.
Bray and Enniskerry Railway Co.	Under cons.	3·25	5	3	6										
Brighton Corporation	Nov., 1901	9·5	17·2	3	6	101 G	10	40	50	4	..	..	Stm. Turb.	1,080	Macartney & Co. Westinghouse Blackwell & Co.
Brighton Beach (1) .. .. .. Mr. Magnus Volk	Aug., 1883	1·5	1·75	2	8½	35 V	110	200	8	2	B	1	Gas	20	Siemens Bros.
Bristol—Bristol Trys. Co.	Oct., 1895	29	51	4	8½	92½G	10	30	232	6	D-C.	4	V. Cp. C.	3,000	British T-H. and Blackwell & Co.
Burnley Corporation	Mch., 1901	10·75	19·52	4	0	102 & 107 G	9·8	35	47	*7	D-C.	7	H. Cp. C.	..	British T-H.
Burton and Ashby Light Railway..	July, 1906	10·2	12·3	3	6	90 & 95 G	11	55	20	2	D-C.	2	Diesel	480	Dick, Kerr & Co. Brush Co.
Burton-on-Trent Corporation ..	Aug., 1903	6·66	9·90	3	6	90 G	11·21	40	20	4	D.C.	3	V. Cp.	..	Dick, Kerr, & Co. Blackwell & Co.
Bury Corporation	June, 1903	10·5	16	4	8½	102 G	15	40	41	3	..	2	..	..	Westinghouse
Camborne and Redruth	Nov., 1902	3·75	4·9	3	6	90 G	15	40	8	5	D.C.	4	Cp.	345	Dick, Kerr, & Co. British T-H.
Cardiff Corporation	May, 1902	17·61	32·6	4	8½	100 G	23	35	130	6	D-C.	6	V. Cp. C.	..	British T-H. Dick, Kerr, & Co.
Carlisle, City of, Elec. Try. Co. ..	June, 1900	7·25	8·5	3	6	83 G	20	30	15	4	D-C.	4	..	600	Dick, Kerr, & Co.
Cavehill & Whitewell Try. Co...	Feb., 1906	3·25	4·5	4	8½	105 G	40	84	10	..	..	..	..	..	J. G. White & Co.
Chatham & District Light Rly. Co.	June, 1902	12·84	21·76	3	6	103 & 92½G	9	35	40	4	D-C.	4	V. Cp.	1,552	British T-H. Co. Brush Co.
Cheltenham and District ..	Aug., 1901	10·25	12·23	3	6	83 & 90 G	8	37	20	..	..	..	..	..	Westinghouse
Chester Corporation..	April, 1903	3·51	6·3	3	6	94 & 100G	30	40	18	*6	D-C.	6	V. Cp. C.	1,800	Blackwell & Co. British T-H.
Chesterfield Corporation	Dec., 1904	3·6	4·5	4	8½	96 G	20	48½	12	4	..	4	V. Cp. C.	..	Milnes & Co. Westinghouse Brush
Clontarf and Hill of Howth ..	July, 1900	5·5	6·5	5	3	87 G	13	34	12	..	..	..	..	..	W. M. Murphy & Co.
Colchester Corporation	July, 1904	6	8	3	6	95 G	12	43	18	6	..	9	V. Cp.	..	Dick, Kerr & Co. J. G. White & Co.
Colne and Trawden Light Railway	Nov., 1903	5·23	6·9	4	0	102 G	13	60	12	*	..	..	..	..	Blackwell & Co. Glover & Co.
Cork Elec. Try. & Lighting Co. ..	Dec., 1898	9·89	15	2	11½	83 G	13	28	35	*6	D-C.	6	H. Cp. C.	1,350	British T-H. Blackwell & Co.
Coventry Electric Tramways Co. ..	Dec., 1895	13·25	15·75	3	6	65 G 84 G	16	40	36	5	2 D-C 2 B	5	H. Cp. C.	600	Westinghouse† Blackwell & Co.
Croydon Corporation	Sept., 1901	12	19·5	4	8½	95·5 G	20	40	70	*3	D-C.	3	..	1,000	British T-H. Co.

* Current from combined lighting and traction station. (1) Third rail system. (2) Combined trolley and conduit systems.

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ELECTRIC TRAMWAYS AND RAILWAYS—*continued.*

Location of Line and Name of Operating Company.	Date of Opening of First Section	Length of Route.	Total Length of Track.	Gauge.		Weight and Type of Rail.	Maximum	Sharpest Curve.	No. of Motor Cars	No. of Dynamos	How Driven.	No. of Engines	Type of Engines.	Total H.P.	Contractors for Electrical Apparatus.
TRAMWAYS—*continued*				ft.	in.	lbs.	1 in	ft. rad.							
Darlington Corporation	June, 1904	4·875	8·875	3	6	90 G	14	46	16	9	..	7	..	..	Westinghouse Milnes & Co.
Dartford U. D. C.	Feb., 1906	6·5	8·5	4	8½	100 G	12	35	12						British I. W.
Darwen Corporation	Oct., 1900	4·36	7·25	4	0	95 G	9	35	17	*4	D-C.	4	H. Cp.	1,500	British T-H.
Derby and Ashbourne	..	14·5	..	4	8½										J. G. White & Co.
Derby Corporation	July, 1904	12·5	21·25	4	0	95 G	17	45	47	3	..	3	Stm. Turb.	..	Brush Co.
Devonport & District Try. Co., Ltd.	June, 1901	8·5	15·5	3	6	90 G	10	30	25	*	..	..	..	..	Blackwell & Co.
Devonport Corporation	June, 1901	..	7	3	6	97 G	10	50	12	..	..	..	..	..	Blackwell & Co.
Doncaster Corporation	June, 1902	8·25	10·375	4	8½	100C.G	25	45	25	5	D-C.	5	..	750	Blackwell & Co.
Dover Corporation	Sept., 1897	4·75	7	3	6	87 G	10·5	44	21	*2	D-C.	2	H.CC.	240	Dick, Kerr, & Co. Blackwell & Co.
Douglas—Port Soderick .. .. Douglas Southern Elec. Trys. Co.	Aug., 1896	3·75	3·75	4	8½	65 V	12	45	8	2	B	2	H. Cp.	260	Westinghouse British T-H. Blackwell & Co.
Dublin & Lucan Elec. Railway Co.	April, 1900	6·75	6·875	3	6	50 V	20	27	6	2	D-C.	2	H.Cp.C.	400	Dick, Kerr, & Co.
Dublin United Tramways Co. ..	May, 1896	47·65	92·5	5	3	92 G	12·37	22	298	6	D-C.	6	V.Cp.C.	5,000	Dick, Kerr, & Co Blackwell & Co. British T-H.
Dudley and Stourbridge Trys. British Electric Traction Co.	July, 1899	21·25	27·22	3	6	90 G	11	50	59	4	D-C.	4	H. Cp.	550	British T-H. Blackwell & Co.
Dumbarton	Feb. 1907	3	3·5	4	7¾	90 & 96	20	46	6	3	D-C.	3	..	..	Dick, Kerr, & Co.
Dundalk	Under cons.	6	6·25	3	6	97 G	10	50	12						
Dundee, Broughty Ferry, and District	Dec., 1905	5	9·9	4	8½	90 G	16	30½	14	2	D-C.	2	V.Cp.C.	500	J. G. White & Co. British T-H. Co.
Dundee Corporation	July, 1900	12·298	25·669	4	8½	94 G	10	33	66	5	D-C.	5	..	2,226	Blackwell & Co.
East Ham Corporation	June, 1901	6·75	12·5	4	8½	90 G	25	42	40	5	D-C.	5	H. Cp.	500	Dick, Kerr, & Co.
Eccles Corporation	May, 1902	5	7·75	4	8½	100 G									
Erith Urban District Council ..	Aug., 1905	4·7	8·4	4	8½	100 G	20	40	14	3	..	5	..	..	Brush Co. Westinghouse Co.
Exeter Corporation	April, 1905	5·5	7	3	6	90 & 92 G	11·5	35	20	*4	D-C.	4	H. Cp.	..	Dick, Kerr, & Co.
Falkirk and District	Oct. 1905	6·25	8	4	0	90 G.	15·5	45	18	..	..	..	..	..	Bruce Peebles & Co.
Farnworth Urban District	Jan., 1902	4·33	7·16	4	8½	98 G	29	36	13	4	D-C.	4	..	3,000	
Felixstowe Pier	1905	0·5	0·5	3	6	30	..	..	3	..		..	..	..	
Gateshead and District	May, 1901	11·28	17·30	3	8½	90 G	8	35	51	*	..	..	..	..	Dick, Kerr, & Co. Blackwell & Co.
Giant's Causeway Elec. Try. Co. ..	Sept., 1883	8	9	3	0	42 V 75 G	24	30	26	2	B	2	Hyd. Turb.	64	Siemens Bros. British T-H.
Glasgow Corporation	Oct., 1898	89·25	179	4	7¾	110 G	11·93	30	759	12	D-C.	12	V. Cp.	11,600 (*b*)	British T-H. Westinghouse Macartney & Co. Blackwell & Co.
Glossop Urban District	Aug., 1903	4·5	5	4	8½	90 G	14	40	8	2	D.C.	3	V. Cp.	300	British T-H.
Gloucester Corporation Light Rly.	May, 1904	9	15	3	6	90 G	25	40	30	4	..	2	C.	..	Brush Co. Dick, Kerr, & Co.
Gosport & Fareham Trys. Co. ..	Jan., 1906	7·5	11·5	4	7¾	95 G	16	37½	22	3	D-C&A-C	3	V.Cp.C.	..	Dick, Kerr, & Co. Brush Co.
Gravesend and Northfleet ..	Aug., 1902	6·5	9·5	4	8½	87 G	11	55	18	*					Dick, Kerr, & Co.
Great Crosby	June, 1900	2·5	2·5	4	8½	92½ G	..	45	14	*	..	..	..	..	Blackwell & Co.
Great Grimsby	Dec., 1901	6	10·11	4	8½	96 G	15	26	36	2	D-C.	2	..	450	Dick, Kerr, & Co.
Greenock and Port Glasgow ..	Oct., 1901	7·75	15	4	7¾	90 G	15	38	39	*					
Guernsey Railway Co.	Nov., 1892	2	3	3	8½	74 V 84 G	60	60	11	2	B	2	Cp. C.	160	Siemens Bros., & British T-H.
Halifax Corporation	June, 1898	37	51·875	3	6	97 G	9·6	40	95	*7	D-C.	7	H. Cp.	1,200	Electric Cons. Co. British T-H.
Hampshire Light Railway (Elec.) Co.	March, 1903	6	9	4	8½	..		..	10	*					
Hartlepool Electric Tramways Co.	May, 1896	6·72	8·3	3	6	87 G	15	35	21	4	D-C	4	V. Cp.	700	Electric Cons. Co. Dick, Kerr, & Co. Macartney, & Co. Blackwell & Co.
Hastings and District (Overhead)	July, 1905	10	17	3	6	90 G	9	36	40	5	D-C.	4	V. Cp.	1,700	Dick, Kerr, & Co.
,, ,, (Dolter System)	Jan., 1907	1	2	3	6	90 G									
Herne Bay Pier .. .. Herne Bay Pier Co., Ltd. (1)	Mch., 1899	·75	·75	3	0	20 V	..	..	3	1	B	1	Gas	83	British T-H. Blackwell & Co.
Heywood Corporation	Mch., 1906	5·125	6·625	4	8½	90 G	17	..	..	..	..	..	..	..	Blackwell & Co. B.I. & H.C. Co.
Houghton-le-Spring (See Sunderland Dist. Elec. Trys.)															
Huddersfield Corporation	Feb., 1901	28	35·5	4	7¾	98 G	11	35	70	4	D-C.	4	V.Cp.C.	..	British T-H. Greenwood & Batley, Blackw'll & Co.
Hull Corporation	July, 1899	13	26	4	8½	94 G	20	30	116	5	D-C.	5	V.Cp.C.	1,410	British T-H., & Westinghouse
Ilford Urban District	Mar., 1903	6·5	10·5	4	8½	100 G	13	40	22	5	D-C.	5	..	2,200	British T-H., & Dick, Kerr, & Co.
Ilkeston Corporation	May, 1903	3·5	4	3	6	90 G	12·5	28	13	2	D-C.	1	..	..	Dick, Kerr, & Co.
Ipswich Corporation	Nov., 1903	10·8	14·9	3	6	90 G	11·5	40	36	8	D-C.	8	..	..	Westinghouse
Isle of Man—															
Manx Elc. Try. Co. Douglas to Ramsey ..	July, 1893	18	35·75	3	0	62½ V	24	90	22	9	D-C	11	V. Cp.	500	Mather & Platt
Snaefell Mountain (1)	Aug., 1895	4·5	9·5	3	0	56 V	12	90	7	10	D-C.	11	H. Cp.	600	Mather & Platt
Isle of Thanet Elec. Trys. & Ltg. Co., Ltd.	April, 1901	9	11	3	6	90 G	11	30	60	4	D-C.	4	2 V. Cp. 2 H. Cp	1,350	British T-H. Blackwell & Co.
Jarrow and District	Nov., 1906	2·5	3·4	4	8½	95 G	12·5	50	8	..	..	..	..	..	Brush Co. B.I. & H.C. Co.
Kearsley Urban District	Jan., 1902	1·75	1·75	4	8½	95 G	20	..	..	..	..	..	..	..	Westinghouse
Keighley Corporation	Oct., 1904	3·5	6·25	4	0	95 G	25	60	12	3	D-C.	3	..	..	Blackwell & Co. Brush Co.
Kidderminster—Stourport British Electric Traction Co.	May, 1898	4·6	4·87	3	6	75 G	14	45	13	*5	..	5	Stm Turb.	..	Brush Elc. Eg. Co.
Kilmarnock Corporation	Dec., 1904	4·25	4·75	4	8½	90 G	24	45	14	3	D-C.	3	..	..	Blackwell & Co.
King's Norton & Northfield U. D.	May, 1904	5·25	8·25	3	6	105 G	15&21	100&145	..	..	..	..	..	..	Blackwell & Co.
Kinver	April, 1901	4	4	3	6	63 & 90 G	..	..	6						
Kirkcaldy Corporation	Feb., 1903	5·25	7·5	3	6	87 G	11	45	22	6	D-C.	6	..	910	British T-H. Co. Milnes & Co.
Lanarkshire Tramway Co... ..	July, 1903	12·56	25·12	4	7¾	96 & 101 G	11·2	36	46	4	D-C.	4	3 H. Cp. 1 V. Cp.	1,100	British T-H. Co.
Lancashire United Tramways Co.	Oct, 1902	37·5	47·5	4	8½	92 G	15	40	90	*5	D-C&A-C	5	V. Cp.C.	..	B. I. W. Co.
Lancaster Corporation	Jan., 1903	3·75	4·75	4	8½	90 G	10	35	12	4	..	4	V. Cp.	..	Milnes & Co. Greenwood & Batley, Ltd.
Llandudno and Colwyn Bay ..	Oct., 1907	7·5	..	3	6	90 G	..	..	14	*	..	..	..	..	Bruce Peebles & Co.
Leeds City	July, 1897	51·2	96·62	4	8½	100 & 105 G	11	32	270	5	D-C.	6	H. Cp.	4,050	Elec. Con. Co. Greenwood & Batley, British T-H. Blackwell & Co.

B. T. H.
MAGNETIC TRACK BRAKE

The use of this brake makes it impossible for a car to get out of hand at any time and eliminates the danger of skidding wheels.

It combines the advantages of a powerful and reliable slipper brake, applied by hand, and a convenient and efficient magnetic brake, applied through the controller. If desired, both methods of application can be used at the same time in order to secure better braking effect. Tests made in actual service, both on wet and greasy rails, have demonstrated its thorough reliability.

THE BRITISH THOMSON-HOUSTON Co., Ltd.,

Electrical Engineers and Manufacturers.

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London Office:
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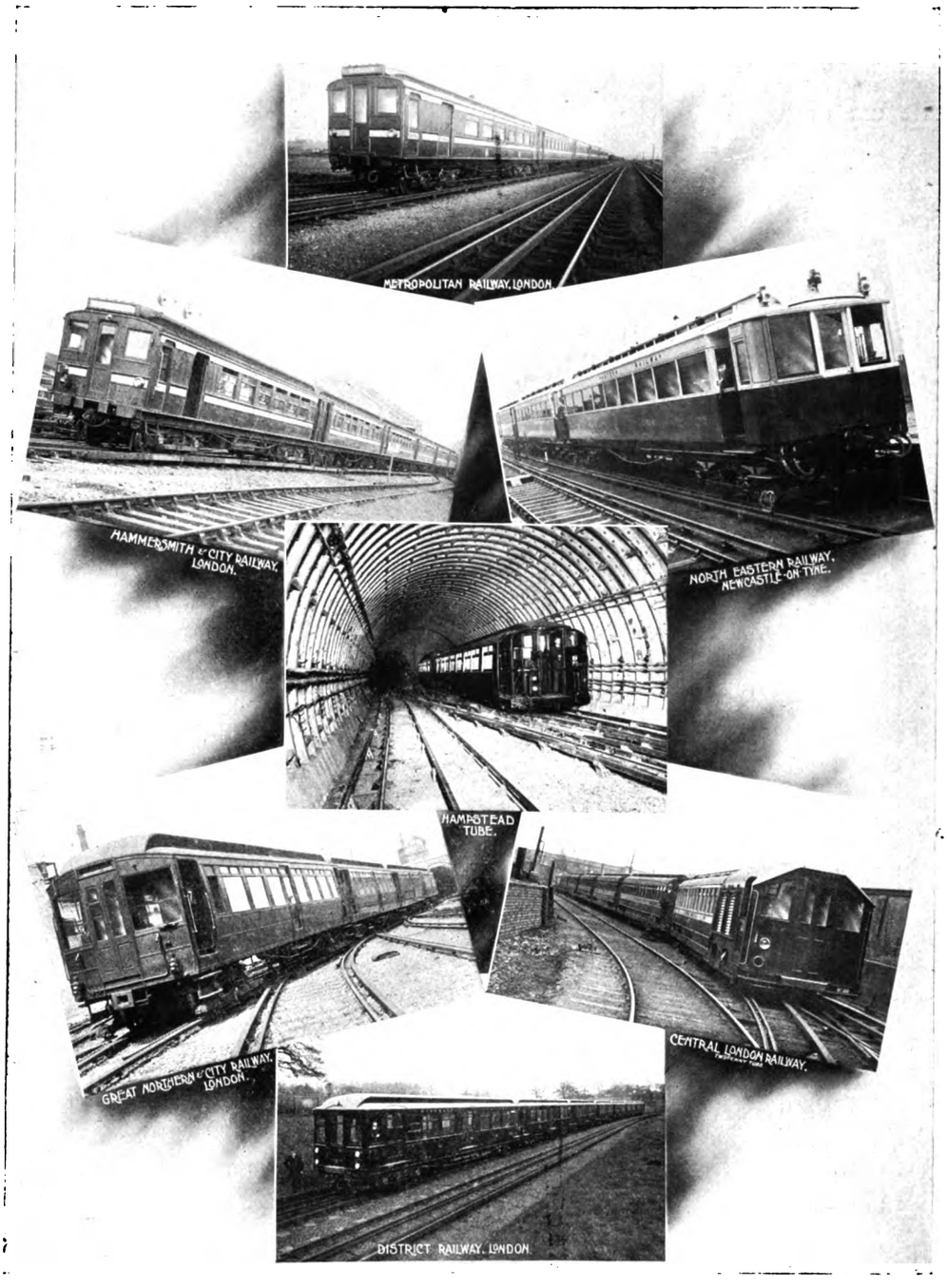
EXPERTS IN HEAVY ELECTRIC TRACTION.



THE BRITISH THOMSON-HOUSTON CO., LTD.,

Electrical Engineers and Manufacturers,

Head Office and Works: RUGBY. **London Office: 83, Cannon Street, E.C.**

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ELECTRIC TRAMWAYS AND RAILWAYS—*continued from page* xxviii.

Location of Line and Name of Operating Company.	Date of Opening of First Section	Length of Route.	Total length of Track.	Gauge.		Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	How Driven.	No. of Engines	Type of Engines.	Total H.P.	Contractors for Electrical Apparatus.
TRAMWAYS—*continued.*				ft.	in.	lbs.	1 in	ft. rad.							
Leamington & Warwick Elec. T. Co.	July, 1905	3·04	6·1	3	6	65 G	12	47	12	3	..	3	Cp.	..	Brush Co.
Leicester Corporation	May, 1904	20	37	4	8½	100 G	16	40	140	4	D-C.	4	V. Cp.C.	..	Dick, Kerr, & Co. Blackwell & Co.
Leith Corporation	Aug., 1905	6	12	4	8½	106·7 G	19	54	37	4	D-C.	9	..	..	S. Dixon & Son Brush Co.
Leyton Urban District	Dec., 1906	9·25	18	4	8½	B.S. 4	22	45	60	2	..	2	..	..	..
Lincoln Corporation (3)	Nov., 1905	1·75	3	4	8½	100 G	..	..	8	9	..	8			
Liverpool Corporation	Nov., 1898	57·5	104	4	8½	95 G	14	40	501	*55	D-C.	55	V. Cp. Trip Exp	..	Blackwell & Co. British T-H. Dick, Kerr, & Co. Westinghouse
Liverpool Overh'd Ry. (Trol.Ln.Ex.)	June, 1900	2·5	2·5	4	8½	92½ G	Nil	45	14	8	D-C.	7	..	220	Dick, Kerr, & Co.
Llandudno and District	Oct., 1907	7·25	..	..		..	..	..	..	..	..	..	..	..	Bruce Peebles & Co.
London County Council (2 and 3) .. (Electric lines) (4).	May, 1903	66·93	133·86	4	8½	104 G	22	45	1050	4	D-C.	4	V. Cp.C.	..	Dick, Kerr, & Co. Westinghouse J. G. White (Track)
London United Tramways Co. ..	April, 1901	56	104·5	4	8½	92½ G	19	32	340	7	D-C.	5	V. Cp.	4,700	British T-H. Westinghouse. Blackwell & Co.
Lowestoft Corporation	July, 1903	4·75	5·39	3	6	100 G	27	36	19	6	..	5	..	..	Blackwell & Co.
Luton Corporation Tramways .. (Leased to J. G. White & Co., Ltd.)	Feb., 1908	5·25	6·25	4	8½	95 G	11	36	12	*1	D-C.	1	..	..	J. G. White & Co.
Maidstone Corporation	July, 1904	2	2·25	3	6	95 G	14	45	7	5	D-C.	5	..	..	Dick, Kerr & Co.
Manchester Corporation	June, 1901	101·75	176·75	4	8½	102 G	14·9	35	566	*25	D-C.	25	..	..	Macartney, McElroy & Co. British T-H. Dick, Kerr, & Co.
Mansfield and District Co. ..	July, 1905	10	12·33	4	8½	90 G	17	50	18	*3	..	3	..	..	
Merthyr	April, 1901	2·98	3·94	3	6	90 G	10	38	15	5	D-C.	5	H.S.V.	700	Dick, Kerr, & Co.
Metropolitan Electric Trys., Ltd.	July, 1904	27	54	4	8½	100 G	15	40	180	4	..	4	Turbs.	4,000	British T-H. Brush Co.
Mexborough & Swinton .. Tramways Co. (5) ..	Feb., 1907	7	10·75	4	8½	90 G	10	47	16	3	..		..	..	Brush Co. Mountain & Gibson
Middlesbro', Stockton, & Thornaby Electric Tramways Co.	July, 1898	8·5	15	3	6	92 G	17	30	60	3	D-C.	3	H. Cp.	1,200	British T-H. Blackwell & Co.
Middlesex County Council.. ..	Aug., 1904	25·5	51	4	8½	..	..	..	..	..	..	..	..	..	..
Middleton Corporation	..	2·5	5	4	8½	..	..	..	..	..	..	..	..	..	..
Middleton Electric Traction Co. ..	Mch., 1902	8·5	9·75	4	8½	92 G	18	45	27	3	D-C.	3	..	400	Glover & Co.
Musselburgh and District ..	Dec., 1904	3	5·25	4	8½	90 G	34	48	14	3	D-C.	4	..	300	B. T-H. Co., Nat. Elec. Cons. Co.
Nelson Corporation	Feb., 1903	2·75	3·75	4	0	106 G	11	41	9	4	D-C.	4	..	..	Blackwell & Co. British T-H. Co. Brush Co.
New St. Helens & District Trys. Co.	July, 1899	20·25	22	4	8½	95 G	14	35	36	*4	D-C.	4	V. Cp.C.	1,240	Westinghouse British T-H.
Newcastle Corporation	Dec., 1901	27·875	57	4	8½	101 G	9	35	185	5	D-C.	5	V. Cp.	7,800	Westinghouse British T-H.
Newport (Mon.) Corporation ..	April, 1903	7·5	14·75	4	8½	96 G	10	35	40	5	..	5	V. Cp.	..	Milnes & Co. Westinghouse
Northampton Corporation	July, 1904	5·5	9·5	3	6	90 G	17	55	22	3	..	3	V. cond.	..	Dick, Kerr, & Co. Brush Co.
North Shields Tramways Co. ..	Mar., 1901	..	7·75	3	6	90 G	10	36	22						
North Staff. Trys. (*Vide* Potteries)															
Norwich Electric Tramways Co. ..	July, 1900	14·5	19·5	3	6	65½ G	12·5	38	47	4	D-C.	4	H. T. Cp.	1,100	Westinghouse Blackwell & Co.
Nottingham Corporation	Jan., 1901	19·25	36·5	4	8½	107 G	11·5	40	125	3	..	3	..	..	British T-H. & Dick, Kerr, & Co. Blackwell & Co.
Oldham, Ashton & Hyde Trys. Co.	June, 1899	9·12	11·75	4	8½	96 G	11	26	46	*3	D-C.	3	V. Cp.C.	1,950	British T-H. Blackwell & Co.
Oldham Corporation	Dec., 1900	23·7	35·64	4	8½	100 G	11	40	80	*17	D-C.	17	..	..	Dick, Kerr, & Co.
Paisley & District Tramways Co.	June, 1904	14·68	25·07	4	7¾	90 G	13	35	60						
Perth Corporation	Oct., 1905	5·7	7	3	6	90 G	16	..	12	5	..	5	..	..	Blackwell & Co.
Peterborough Elec. Traction Co...	Jan., 1903	5·33	6·71	3	6	94 G	40	35	14	..	..	..	..	..	Blackwell & Co. Dick, Kerr, & Co.
Plymouth Corporation	Sept., 1899	7·75	13·5	3	6	92 G	9	35	42	3	D-C.	3	V. Cp.	1,050	Elec. Cons. Co Westinghouse Blackwell & Co.
Plymouth, Stonehouse, and Devonport	Nov., 1901	4·3	7	3	6	84 G	11	34	14	..	..	..	..	..	Blackwell & Co. Dick, Kerr, & Co. Brill Co.
Pontypridd Urban District ..	Mar., 1905	5·75	16·6	3	6	95 G	11	35	20	4	..	4	V.C.Cp.	..	B. I. W. Co. Blackwell & Co.
Portsdown & Horndean Tramway	Mch, 1903	6	8·75	4	7¾	96 G	16	40	16	2	D.C.	2	..	..	Dick, Kerr, & Co. Brush Co.
Portsmouth Corporation	Sept., 1901	14·5	28·5	4	7¾	96 G	17	35	100	5	D-C.	4	V.Cp.C.	1,600	Macartney, McElroy & Co. Dick, Kerr, & Co.
Potteries Extension .. Potteries Electric Traction Co.	May, 1899	31·675	39·81	4	0	87 G	10	45	110	8	D-C.	11	H.Cp. V.Cp.	3,000	Dick, Kerr, & Co. Blackwell & Co.
Preston Corporation..	June, 1904	10·54	17·22	4	8½	95 G	16	32	30	2	D-C.	2	H.C.Cp.	..	Dick, Kerr, & Co.
Radcliffe Urban District ..	April, 1905	5	6·5	4	8½	100 G	15	40	..	2	..	2	V. Cp.		
Reading Corporation	July, 1903	7·25	13·25	4	0	96 G	16	40	36	4	D.C.	4	V. Cp.	..	Blackwell & Co. Dick, Kerr, & Co. Westinghouse
Rhondda Tramways Co.	Under cons.	6·75	13	4	8½	..	..	..	50	..	..	..	..	..	British T-H. Brush
Rochdale Corporation	May, 1902	19·58	28·2	4	8½	103½ G	11·7	30	59	7	D-C.	7	..	..	British T-H. Dick, Kerr, & Co.
Rossendale Valley..	Jan., 1899	6·5	8	4	0	88 G	14	37	12	..	..	..	..	..	Brush Co.
Rotherham Corporation	Jan., 1903	8·71	10·71	4	8½	88½ G	10·5	45	30	8	D-C.	8	H.S.Cp.	1,260	Dick, Kerr, & Co.
Rothesay	Aug., 1902	4·81	9·62	3	6	94 G 77 G	23	120	20	3	D-C.	3	H. & V.	500	Dick, Kerr, & Co. Westinghouse
Ryde Pier, Isle of Wight .. Ryde Pier Co. (1)	Mch., 1886	·5	1	4	8½	30 & 34 V	..	..	4	2	B	2	Gas	36	Siemens Bros.
Salford Corporation	Oct., 1901	41·23	74·75	4	8½	103 G	20	45	166	*8	D-C.	8	V. Cp.C.	..	Westinghouse Mather & Platt
Scarborough Tramways Co. ..	May, 1904	4·75	8	3	6	90 & 91 G	11	35	22	2	..	2	Stm. Turb.	800	Brush Elec. Co.
Sheerness and District	April, 1903	2·5	3	3	6	94 G	43	45	8	3	D-C.	3	V.Cp.C.	500	Siemens & Halske Brush Co.
Sheffield Corporation	Sept., 1899	35·88	65·95	4	8½	108½ G	9·5	36	258	7	D-C.	7	3 H.Cp. 4 V.Cp.	2,500	British T-H.

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ELECTRIC TRAMWAYS AND RAILWAYS—*continued.*

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge.		Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	How Driven.	No. of Engines	Type of Engines.	Total H.P.	Contractors for Electrical Apparatus.
				ft.	in.	lbs.	1in.	ft. rad.							
TRAMWAYS—*continued.*															
SHIPLEY URBAN DISTRICT	May, 1902	6	10	4	0	90 G	15	..	.	4	..	3	..	..	British T-H.
SOUTHAMPTON Corporation	Jan., 1900	9·5	16	4	8½	105 G	14	45	53	6	D-C.	6	H.Cp.C.	..	Westinghouse
SOUTHEND Corporation	July, 1901	6·36	7·5	3	6	90 G	18	48	22	6	D-C.	6	..	..	British T-H.
SOUTHEND PIER (1) Southend Corp.	Aug., 1890	1·25	1·25	3	6	60 G	Lev	18	16	2	B	2	H. Cp.	66	British T-H.
SOUTH METROPOLITAN Elec. Try. Co.	Feb., 1906	13·36	26·75	4	8½	95 G	9	42½	52	2	..	..	..	..	Dick, Kerr & Co. Brush Co.
SOUTHPORT Corporation	July, 1900	8·5	10·75	4	8½	87 & 90 G	25	45	26	3	D-C.	3	H. Cp.	600 kw	Macartney & Co.
SOUTHPORT Electric Tramway Co...	July, 1901	9·121	9·78	4	8½	87 G	Nil	40	21	*					Dick, Kerr, & Co.
SOUTHPORT PIER	..	0·6	0·6	3	6	..	..	..	3						
SOUTH SHIELDS Corporation ..	Mar., 1906	7	13	4	8½	95 G	..	..	35	2	D-C.	2	V. Cp. C.	2,200	Dick, Kerr & Co.
SOUTH STAFFORDSHIRE	Jan., 1893	18·98	29·5	3	6	97 & 90 G	17	46	46	3	R.	3	C.H.Cp.	350	Blackwell & Co. E. C. C.
STALYBRIDGE, HYDE, MOSSLEY, and DUKINFIELD	May, 1904	23·5	30·75	4	8½	99 G	9	27½	55	3	..	3	..	2,250	
STOCKPORT Corporation	Aug., 1902	14	23	4	8½	96 G	10	40	40	4	D-C.	4	..	900	Macartney & Co. Dick, Kerr, & Co.
SUNDERLAND Corporation	June, 1900	10·87	19·54	4	6	96 G	14	35	70	*4	D-C.	4	..	1,500	Dick, Kerr, & Co.
SUNDERLAND District Electric Trys.	June, 1905	14·5	28	4	8½	90 G	11	40	30	*					
SUTTON & HOWTH (G.N.R., Ireland)	June, 1901	5·75	6·75	5	3	72 B	16·7	300	11	3	D-C.	3	..	750	British T-H. Westinghouse
SWANSEA Tramways Company ..	June, 1900	5·5	8·5	4	8½	86 G	22	40	55	4	D-C.	4	H.Cp.C.	1,000	British T-H.
SWINDON Corporation	Sept., 1904	3·7	4·52	3	6	105 G	14	37½	12	5	..	4	..	..	Dick, Kerr & Co. J. G. White & Co.
TAUNTON AND WEST SOMERSET ..	Aug., 1901	1·25	1·5	3	6	90 G	25	40	6	*	..	..	..	..	Blackwell & Co.
TORQUAY Tramways (4)	Feb., 1907	8	11·5	3	6	90 G	11	31	18	*					
TRAFFORD PARK Estates, Ltd. (Trys.)	July, 1903	2·5	3	4	8½	98 G	..	35	7	4	D.C.	4	TandCp.	..	Westinghouse
TYNEMOUTH and DISTRICT	Mar., 1901	4·25	7·3	3	6	90 G	10	30	22	*3	D-C.	3	..	500	Blackwell & Co.
TYNESIDE Tramways & Tramroads Co.	Sept., 1902	8·91	12·66	4	8½	95 G	10	40	24	*					
WAKEFIELD & DISTRICT Lgt. Rlys. Co.	Aug., 1904	24·69	40·383	4	8½	96 G	15·6	36	67	3	D-C.	5	..	1,600	Dick, Kerr, & Co.
WALLASEY Urban District	Mch., 1902	8·5	11·85	4	8½	98 G	14	45	40	*3	D-C.	3	V. Cp. C.	1,190	Lanc. Dynamo Co. Blackwell & Co.
WALSALL Corporation	Jan. 1904	12	13·56	3	6	90 & 92 G	18	32	28	8	D-C.	7	H. Cp. C.	300	British T-H. Electric Cons. Co.
WALTHAMSTOW U.D.C. Light Rly...	June, 1905	9	11·25	4	8½	100 G	20	36	32	3	..	3	WhgGas	..	Westinghouse Henleys, W. T.
WALTON-ON-NAZE PIER	Aug., 1898	·5	·5	3	6	36 V	..	..	3	2	D-C.	3	..	..	Blackwell & Co.
WARRINGTON Corporation	April, 1902	6·5	9·6	4	8½	90 G	27	50	21	5	D-C.	5	V.C.	..	British T-H. Bruce Peebles & Co
WEMYSS and DISTRICT	Sept., 1906	7·5	9	3	6	95 & 97 lb. G	18	85	9	2	D-C.	2	2 V.Cp.	500	Bruce Peebles & Co Brush Co.
WEST BROMWICH Corporation ..	Dec., 1902	7	12·5	3	6	98 G	17	49	29	8	D-C.	7	..	1,050	Dick, Kerr, & Co. B. I. W. Co
WEST HAM Corporation	Feb., 1904	14·7	26	4	8½	100 G	20	40	100	*3	D-C.	3	V.C.Cp.	..	Milnes & Co. Brush Co.
WESTON-SUPER-MARE	May, 1901	2·9	3·5	4	8½	90 G	25	40	12	4	D-C.	4	Cp.	300	Blackwell & Co. British T-H. Brush Co.
WIGAN Corporation	April, 1901	25	35	3 4	6 8½	100 G	12	45	67	*7	..	7	..	..	Blackwell & Co.
WOLVERHAMPTON Corporation (3) ..	April, 1902	12	20	3	6	96 G	17	..	43	5	D-C.	5	H.Cp.C.	..	Lorain Steel Co. British T-H. Electric Cons. Co.
WOLVERHAMPTON DISTRICT	April, 1900	14·75	19	3	6	90 G	20	40	30	*4	..	..	..	..	B.I.W. & B.T-H. Westinghouse
WORCESTER Electric Traction Co. ..	Feb., 1904	5·875	8·375	3	6	94 G	13	45	15	*3	..	3	..	..	Brush Co. Dick, Kerr, & Co.
WREXHAM and DISTRICT	April, 1903	4	4·38	3	6	97 G	9	47	10	*6	..	..	..	900	British T-H. & Brush Co.
YARMOUTH Corporation	June, 1902	8·5	13	3	6	90 & 95 G	27	48	31	2	..	2	..	600	Brush Co. B.I.W. Co.
YORKSHIRE WOOLLEN DISTRICT ..	Feb., 1903	22	35	4	8½	96 G	8	30	69	*	..	..	..	..	Brush Co. Dick, Kerr, & Co.
RAILWAYS.															
LONDON:															
BAKER ST. & WATERLOO RY. CO. (2)	Mar., 1906	5·25	11·5	4	8½	90 B	60	330	86 M. 72 T.	†	..	..	..	..	Westinghouse British T-H.
CENTRAL LONDON RLY. CO. (1) ..	July, 1900	6·5	13	4	8½	100 V	30	..	68 M. 172 T.	6	D-C.	6	H. Cp. C.	6,800	British T-H.
CHARING CROSS, EUSTON, AND HAMPSTEAD RAILWAY (2)..	June, 1907	8	16·5	4	8½	90 B	33	330	60 M. 90 T.	†	..	..	..	..	Westinghouse British T-H.
CITY & SOUTH LONDON RLY. CO. (1)	Dec., 1890	7·5	14·75	4	8½	60 V 80 V	30	120	52 L. 142 T	7	D-C.	7	2 H.C. 4 V.C.	4,000	Mather & Platt Elec. Cons. Co. British T-H.
GT. NORTHERN & CITY RLY. CO. (2)	Feb., 1904	3·42	7·75	4	8½	85 V	52	660	35 M 45 T	6	D-C.	8	V.Cp.C.	4,500	British T-H.
GREAT NORTHERN, PICCADILLY & BROMPTON RLY. CO. (2)..	Dec., 1906	9	18·5	4	8½	90 B	33	330	72 M. 144 T.	†	..	..	..	..	Westinghouse British T-H.
GREAT WESTERN RAILWAY .. (Hammersmith and City line.)	Nov., 1906	4·9	10·5	4	8½	97½ B	60	400	40 M. 80 T	10	D-C.	10	V.Cp.	10,000	British T-H. Elec. Con. Co. Bruce Peebles
LONDON, BRIGHTON, and SOUTH COAST RAILWAY (5) .. .. (London Bridge to Victoria.)	Under cons.	9	18	..		..	..	..	16 M. 8 T.	..	..	..	..	..	Allgemeine El. Ges British T-H. Blackwell & Co.
METROPOLITAN RAILWAY (2)	Jan., 1905	26	59	4	8½	86 B	44	363	86 M. 172 T.	4	D-C.	4	Turbine	20,000	Westinghouse British T-H.
METROPOLITAN DISTRICT RAILWAY (and running powers) (2)	July, 1905	41	80·46	4	8½	86 B	40	330	234 M. 236 T.	†	..	..	..	..	British T-H. Westinghouse
WATERLOO AND CITY RLY. CO. (1)	Aug. 1898	1·5	3	4	8½	87 B	30	321	17 M. 12 T.	6	D-C.	6	V. C.	2,100	Siemens Bros. Dick, Kerr & Co.
LANCASHIRE AND YORKSHIRE (2) .. (Extensions under construction.)	Mch., 1904	31	65	4	8½	86 B	85	840	38 M. 52 T.	6	D-C.	5	1 V.C. 4 H.C.	9,000	Dick, Kerr, & Co.
LIVERPOOL OVERHEAD RLY. CO. (1)	Mch., 1893	6·75	13·5	4	8½	56 V	40	445½	46 M 7 T	7	R.&D-C	7	H.Cp. V.Cp.	3,600	Electric Cons. Co. Dick, Kerr, &
MERSEY RAILWAY (1)	April, 1903	4·5	9	4	8½	86 B	27	528	24 M. 33 T.	5	D-C.	5	V.Cp.	5,500	Westinghouse Elec. & Mfg. Co.
MIDLAND RLY.—MORECAMBE AND HEYSHAM BRANCH	Under cons.	6													
NORTH EASTERN RAILWAY (1) ..	Mch., 1904	35	80	4	8½	90 B	55	792	60 M. 50 T.	‡	..	..	..	..	British T-H. Co.

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Electric Tramway and Railway Directories

REGULARLY PUBLISHED IN EACH ILLUSTRATED ISSUE OF

THE TRAMWAY AND RAILWAY WORLD

Are withdrawn from this Issue for re-arrangement, but will be inserted hereafter as usual.

The Directories appeared on pages xxxiv—1 of the Issue of May 7, 1908, to which readers are referred in the meantime.

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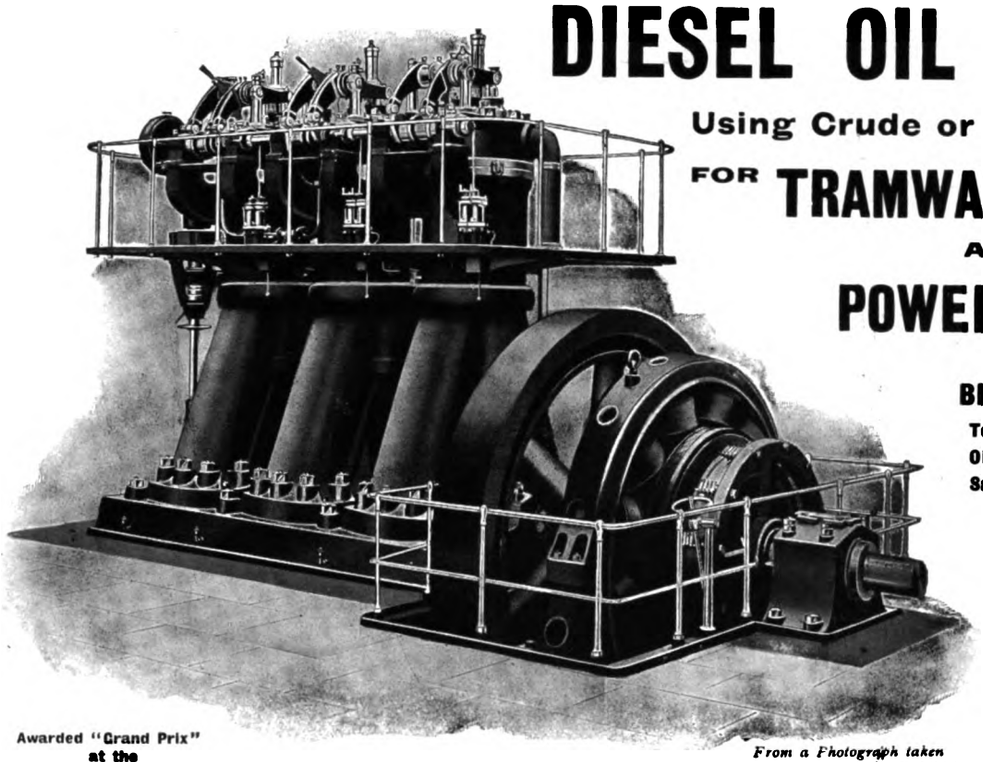

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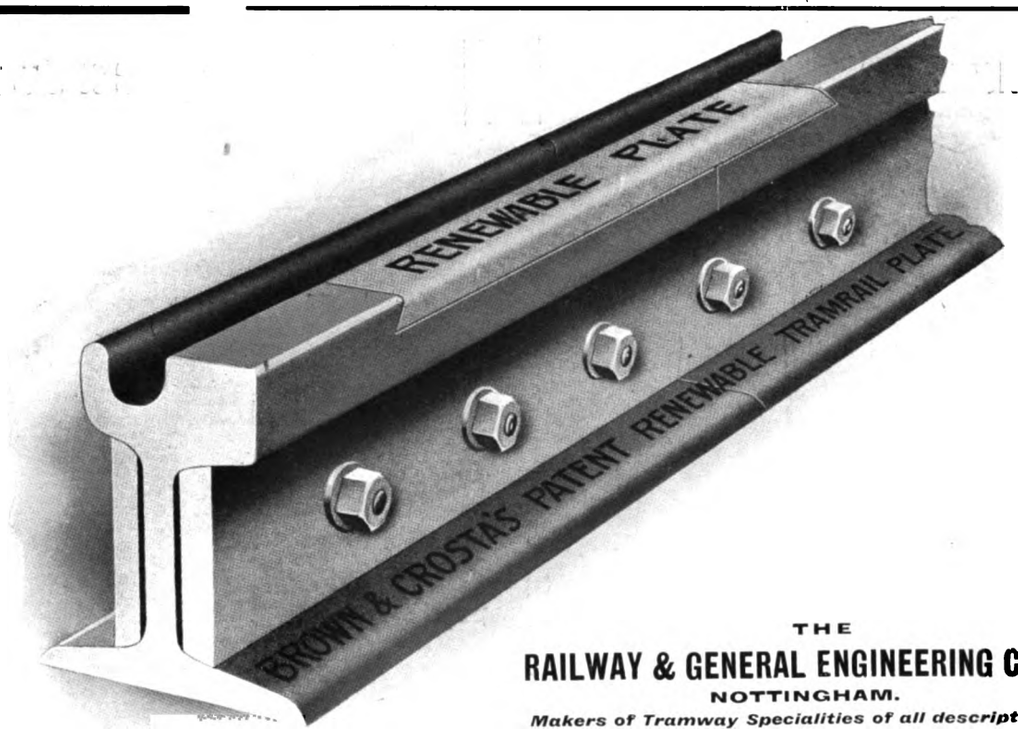

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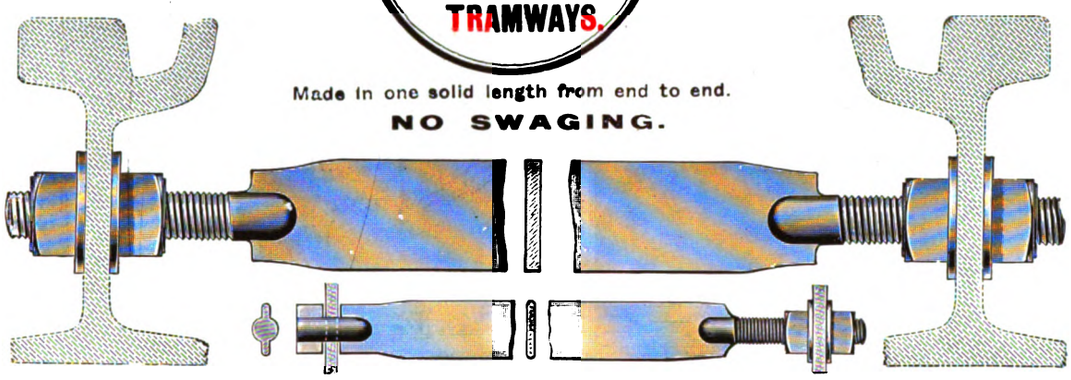

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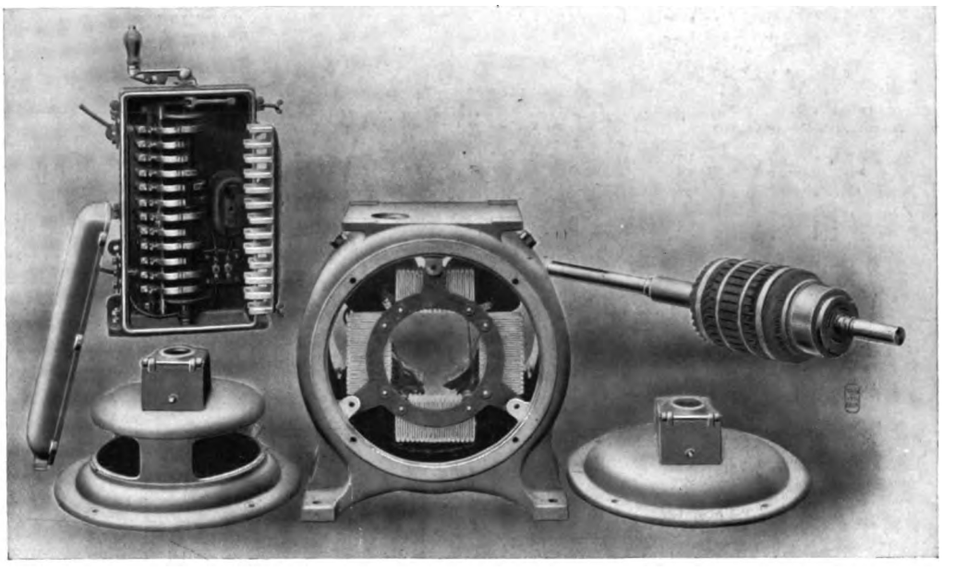

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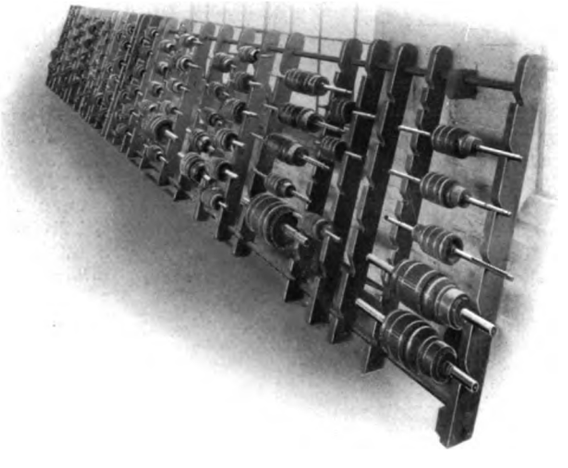

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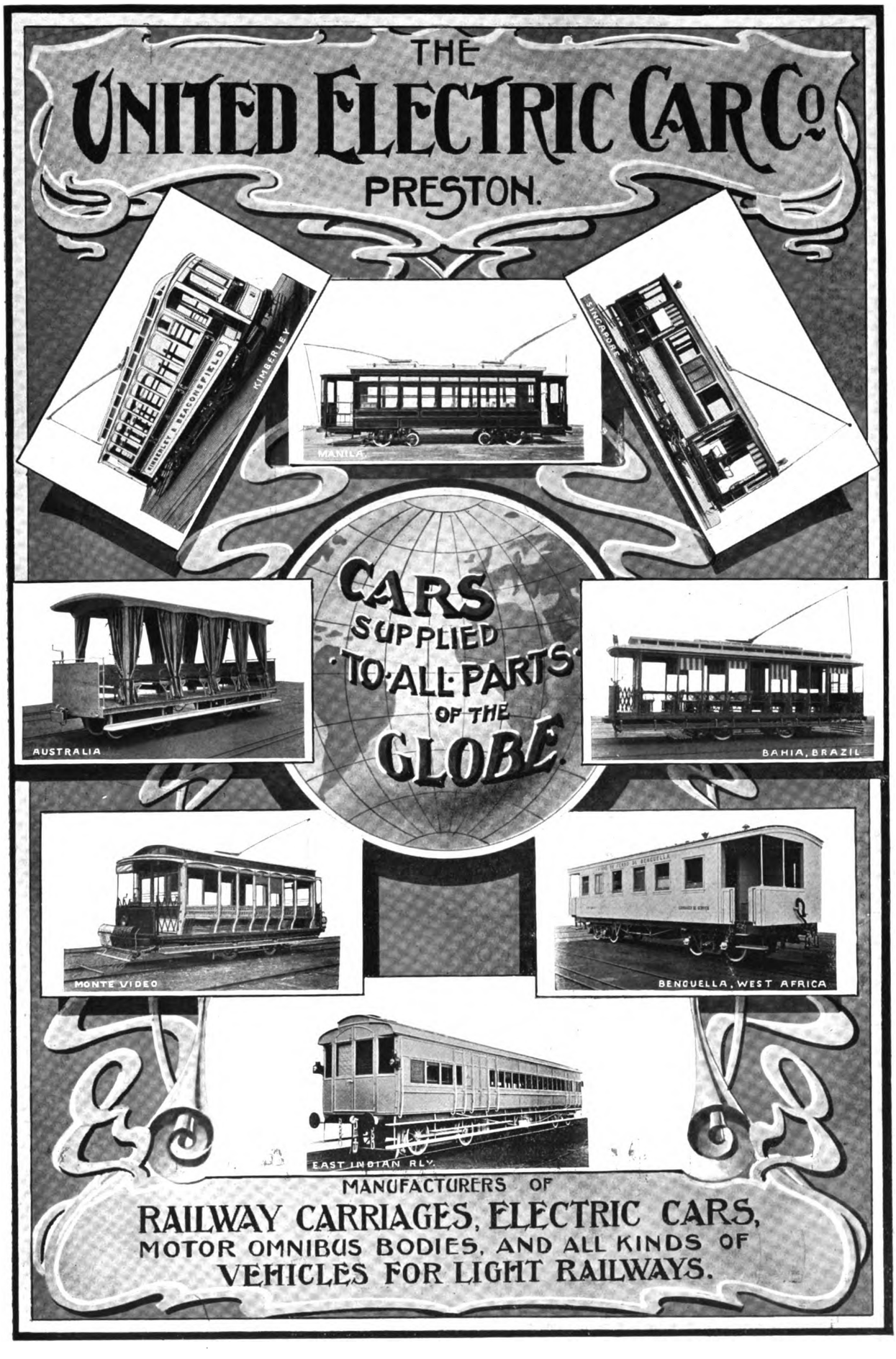

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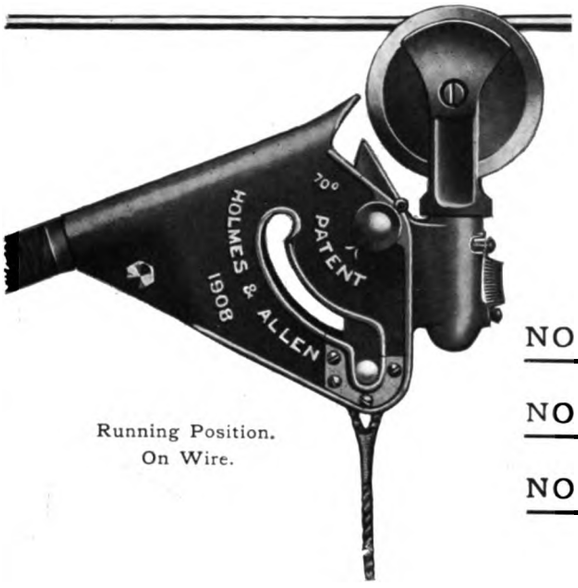

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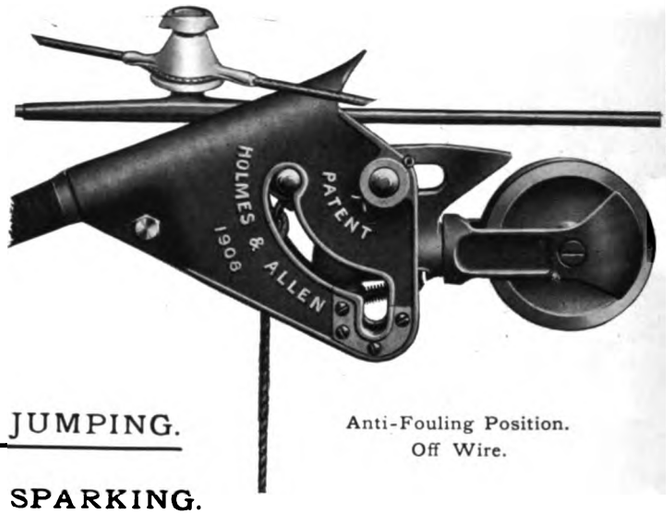

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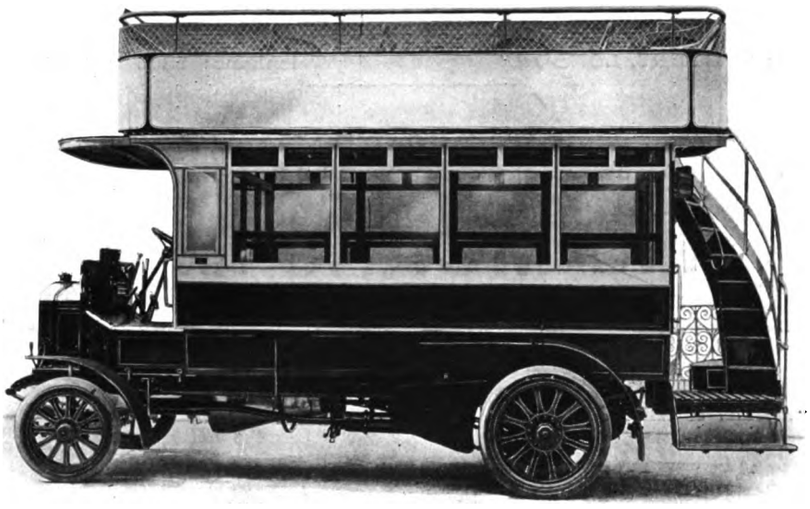

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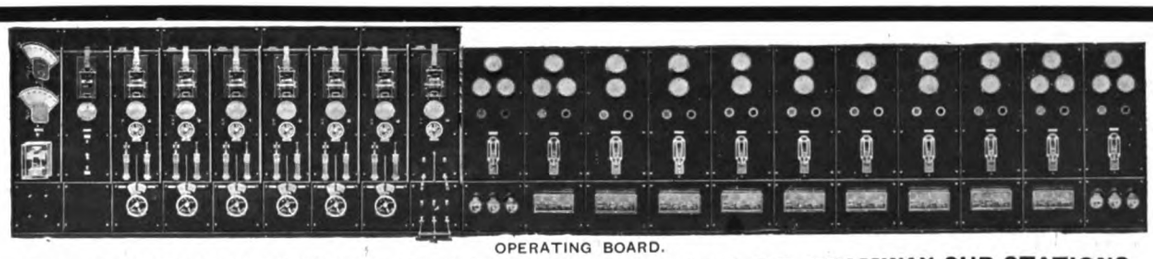

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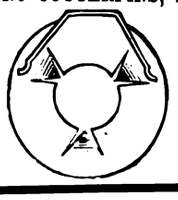

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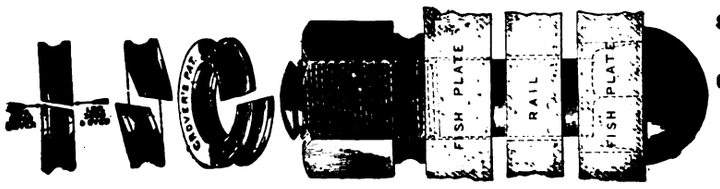

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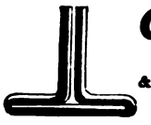

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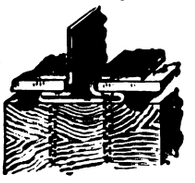

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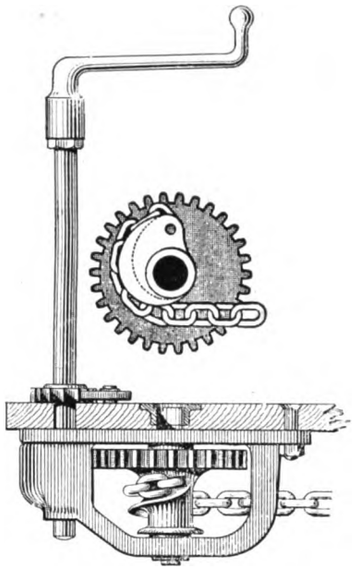

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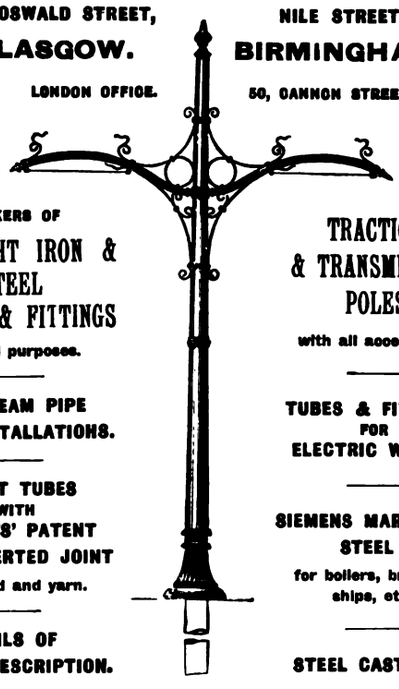

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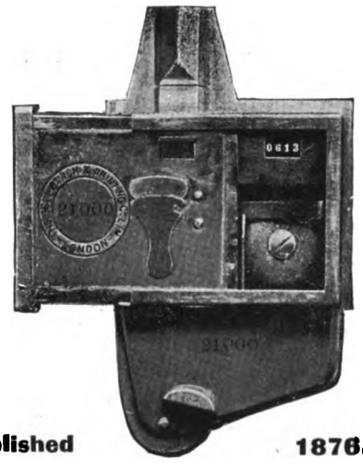

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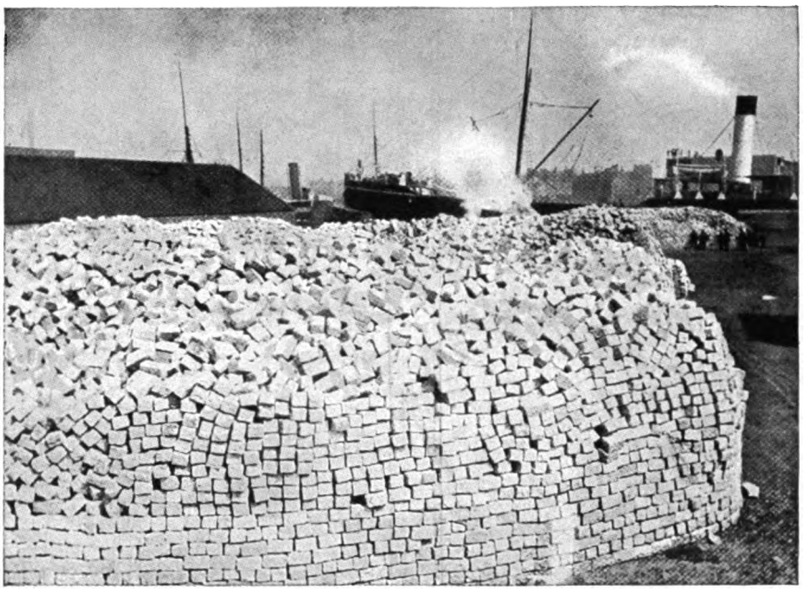

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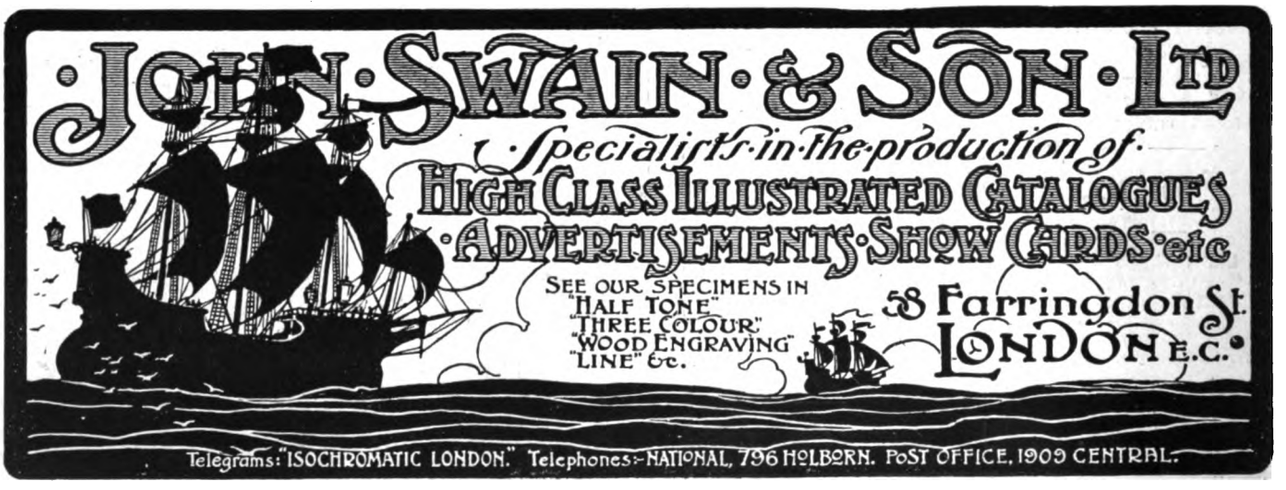

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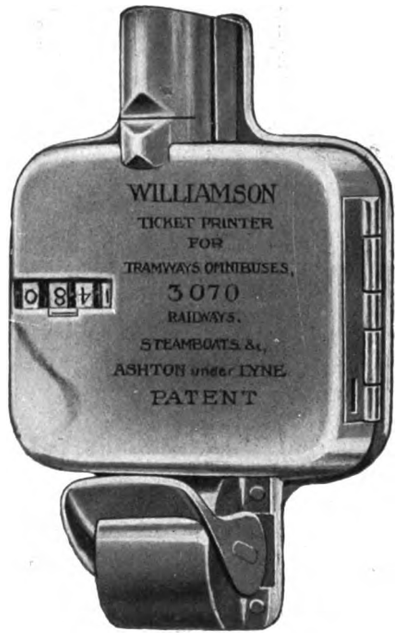

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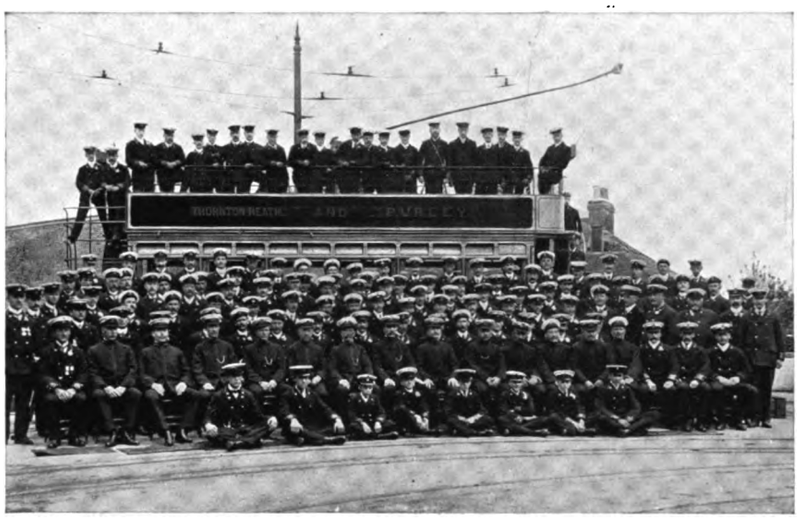

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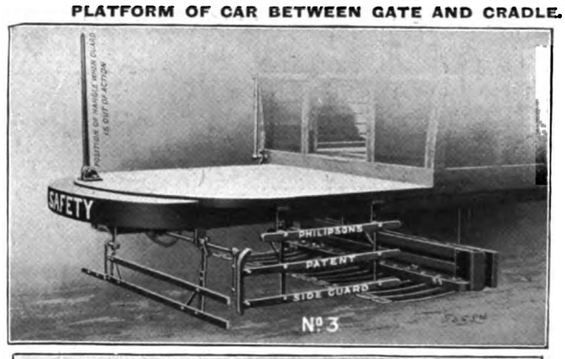

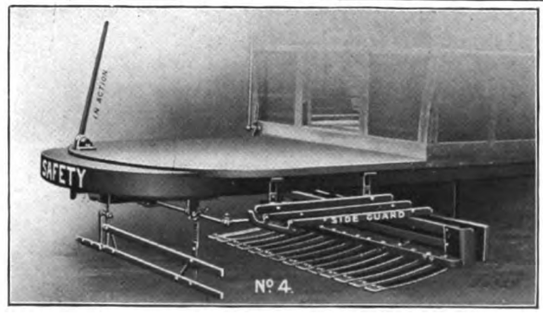

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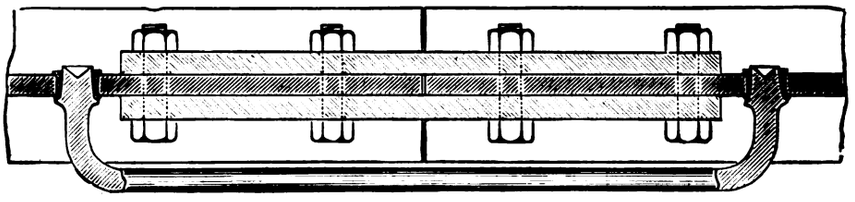

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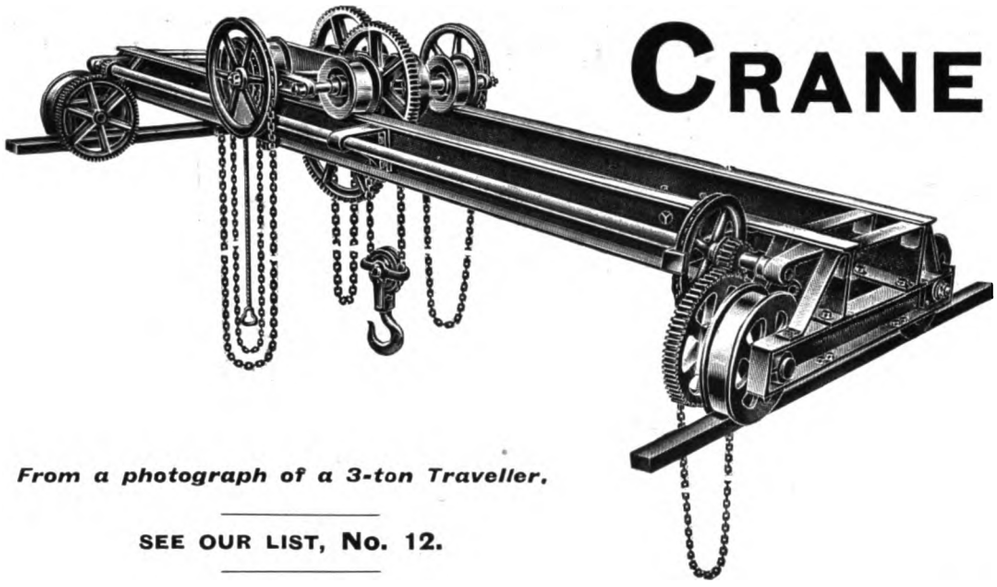

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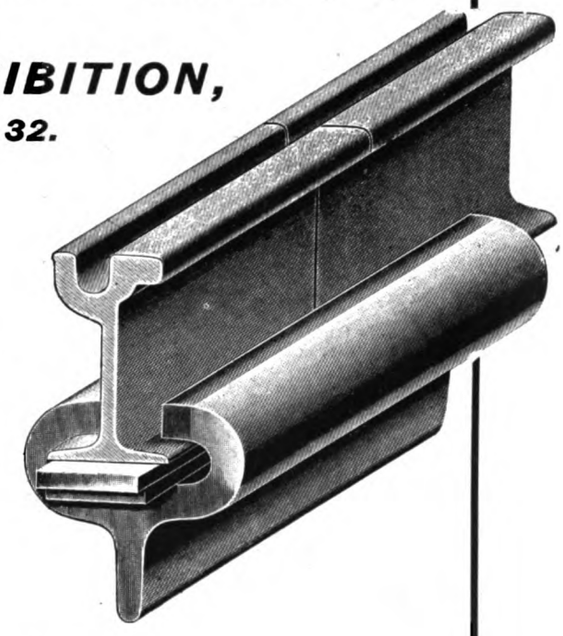

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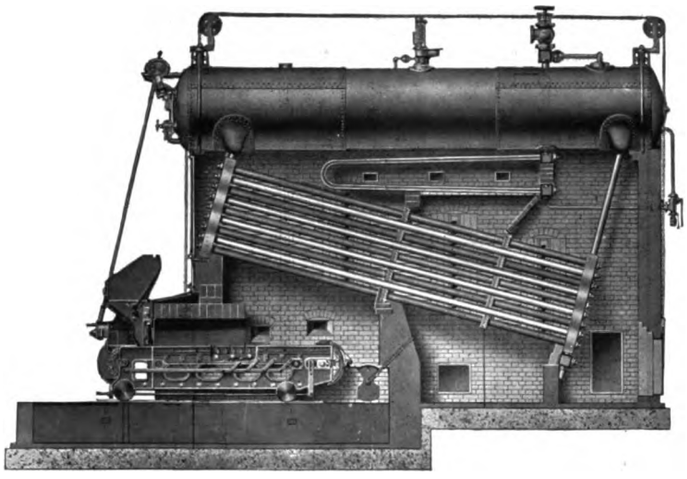

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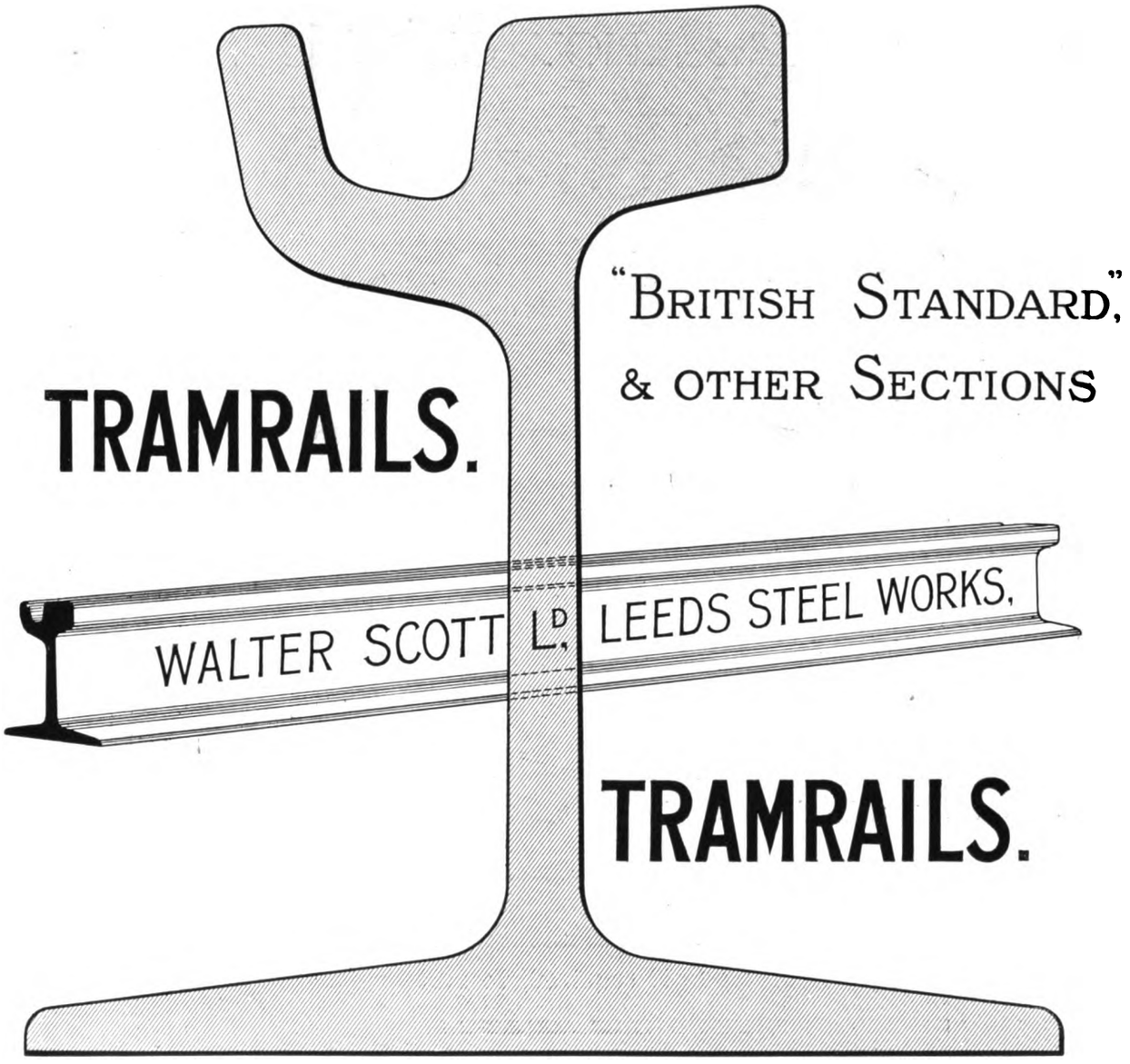

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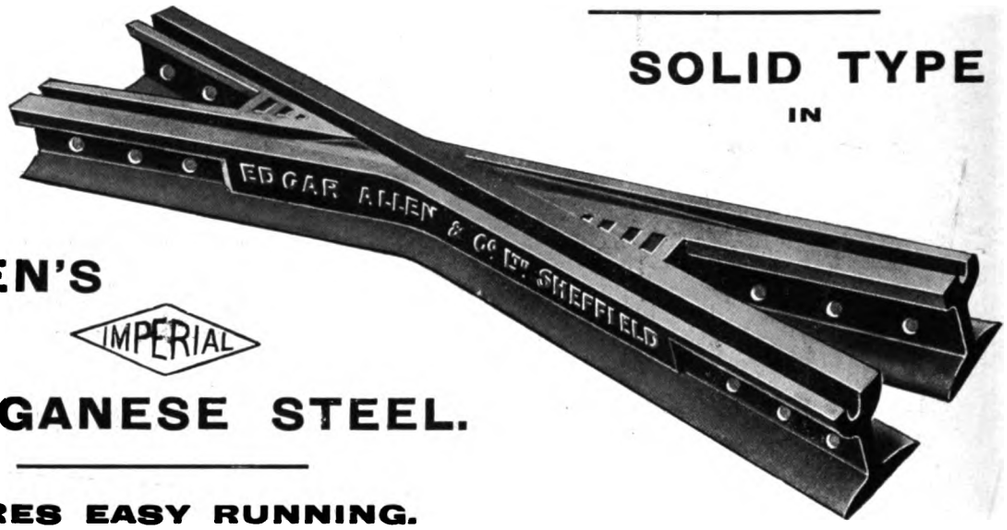

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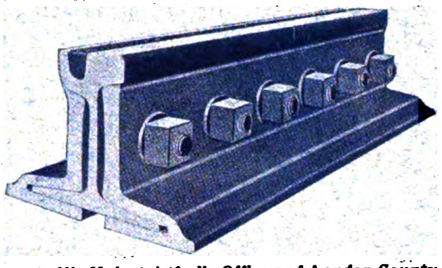

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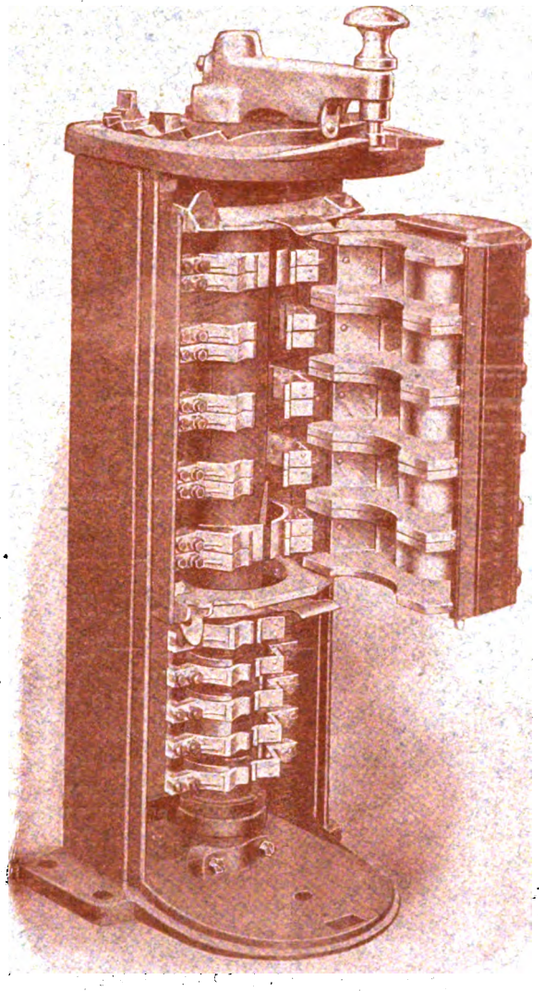

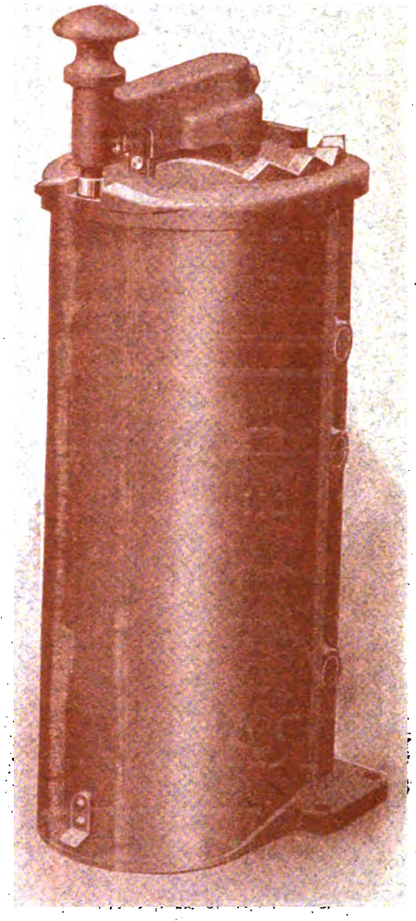

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